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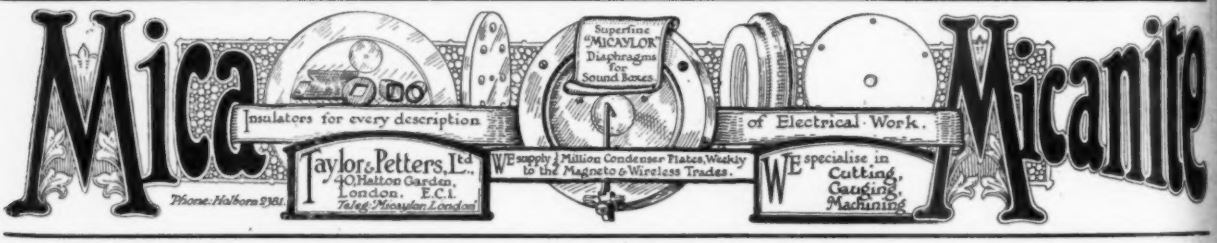
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The

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Domestic Electrical Requirements.

SOONER or later the interest which politicians are taking in the subject of electrical development will result in legislative action. Parliament now stands adjourned, but this is one of the matters to receive further consideration when it reassembles in the autumn, or at any rate early next year, though, of course, all the plans of politicians and public anticipations based thereon are liable to be upset if there is a General Election. On such a point all that we have to do is to wait and see.

But it is certain that whether there be legislation or not the subject of electrical development cannot henceforth be ignored or relegated to a place of insignificance by anybody, for the merits of electricity are now recognised with enthusiasm or else treated as a matter of course, and accelerated electrical progress is hailed with practically complete accord as one of the great hopes of the race both industrially and domestically.

For years past electrical men have been engaged in propaganda efforts to educate the population generally respecting the merits and claims of electricity, and though there will be no room for slackening of such efforts we can congratulate ourselves that the "adoption" of electricity as a subject upon which to appeal to many millions of voters has carried the propaganda movement a big stride forward. In other words, it is a great gain to have the majority of people talking and thinking electrically. The first main purpose has thus been accomplished.

We may regard this progress as having created a new atmosphere congenial for the growth of a much larger electrical apparatus trade, but as we do so, several considerations arise which must have attention. If there be, as we think there will, a new and wider-spread interest in electrical appliances, we shall need to satisfy it by means of specialised rather than general propaganda, feeding the public mind with details, facts and figures, and backing these up with more

demonstrations. It is not suggested that even the general electrical interest of the public will be maintained unassisted, but that general interest will take on practical shape in the form of business as emphasis is particularised and the potential consumer is convinced that the electrical supplier has ready for his or her use the very contrivances that present conditions of daily life have rendered necessary.

Everybody electrical knows how vast is the as yet unsatisfied opening in the British Isles for both domestic and industrial supply. While very gratifying progress is being made in the extension of such custom, the pace can be accelerated if increasing attention be devoted to the actual needs and even the fancies of the consumer. There is a danger lest we become more absorbed in the extension of our electric generating and distributing systems than in the users' end of an installation. Is our ingenuity as fertile as it should be in the discovery and development of new and improved devices? Are those interested in the manufacture and production of electrical appliances as ready to adopt new ideas and make contrivances which are an advance on what they already produce? Competition in ideas is good, but there are conceivable cases where co-operation or combination even of different patented ideas or designs might be a better thing for the consumer, and that should mean a bigger sale for the manufacturer. Is even a gas-electric combination necessarily an abomination? Are manufacturers as ready as they should be to profit from the experience gained by electricity supply engineers and their staffs as they come to close quarters with the consumer who all hours of the day is using electricity and offers useful criticism and suggestions as to how things might better meet varied household conditions? Is there any substantial evidence to show that either designers or manufacturers are seriously facing the problem of the electric cooker boiling ring that has been the subject of comment in our "Correspondence" columns? Propaganda is good, but it will suffer from the efforts of the counter-propagandist unless there be a solid foundation of truth and efficiency.

In the United States there are considerably more than eleven million homes wired for electrical service, and the experience gained therein has been at the disposal of American inventors and manufacturers. It might be imagined that so extensive an experience would have produced apparatus which would be the last word from the consumers' standpoint in any country, but in this connection, as in so many others, conditions are dissimilar on the two sides of the Atlantic, and in the main the British consumers' requirements must be met by British understanding. An interesting editorial in the *Electrical World* stresses the need that exists in the States for more electrical appliances for the home. The point of the article is not that there is any stagnation in the introduction of new variations of lighting and domestic apparatus, but that in some parts of the States so many homes are electrically equipped that the available business in sight is small and consists chiefly in new homes; further, that unless a greater number of electric household devices are forthcoming than at present, the saturation limit for residences will soon be reached. "Hence the necessity for such campaigns as that devoted to better lighting, and hence also the opportunity for manufacturers to bestir themselves in developing and commercialising new household devices." This line of thought develops into an emphasis upon the "virtually untouched" market for a "reasonably priced and foolproof electrical refrigerator." Of such machines, says our contemporary, "many have been called," but "few have been chosen," because prices have been too high, excessive "servicing" has been required, or the machines have not come up to expectations. It seems that practically all electrical interests in the States are on the look-out for an electrical refrigerator possessing the essential features of cheapness and reliability, and our usually serious contemporary says that "the prospects are numbered by millions," for there should be an electrical refrigerator in every home.

Interesting as the subject of refrigeration is to us here, we find in these remarks of our contemporary one more illustration of the difference between the electrical requirements on the two sides of the ocean. The enormous domestic electrical demand in the States fills British suppliers and traders with envy, but that does not alter the conditions in Britain, where we have deeply-rooted and progressive competitive systems to contend against, and a smaller number of people with limitless money to spend upon household equipment, where electric cooking and heating are only just beginning to develop, and the electric washing machine, while it evokes every woman's interest, is adopted only by the comparative few because of its cost.

Excellent work has been and is being done by E.D.A. in educating the public with regard to the benefits to be derived from the use of electricity in the home; but the matter should not rest there. Good as is the material which is now available for domestic use, there is ample scope for improvement in detail, and for the development of new appliances and applications of electricity. Moreover, no effort should be spared to simplify the use, adjustment, and repair of domestic electrical apparatus—a point of the first importance.

The manufacturers and the suppliers of electricity are co-operating in research by supporting the B.E.A.I.R.A., and in commercial development by financing E.D.A.; why should they not go a step further, and set up a committee of experts, after the fashion of the B.E.S.A., to examine and report upon the domestic applications of electricity, and to indicate the directions in which progress can be made for the benefit of the whole industry?

The Copper Outlook.

After some months spent in the doldrums, copper has begun to assume a more hopeful appearance, and, as usual after a period of stagnation, people are beginning to talk of much higher prices being realised, and exaggerated suggestions are current of the possibilities of a famine in the metal. Nothing is less likely, however, than an insufficiency of copper to satisfy the world's needs, and any hopes based upon this are likely to be rudely shattered. The chaotic conditions ruling in Europe as an aftermath of the war and of the peace terms have been the main considerations hitherto holding down prices, and the recent sharp advance found its origin in the belief that some way would be found by the Conference sitting in London to promote the restoration and rehabilitation of the economic and industrial life of Germany, and with it the gradual recuperation of Europe's buying power for copper, and for that matter, for all other commodities. The lack of the boom so confidently predicted by the big American copper magnates soon after the war proved a very great disappointment to them, for it upset all their plans, and while hugging their illusions, they continued turning out copper in quantities which the world could not absorb. Faced again with growing stocks and the imperious necessity of financing them, it became necessary at last to launch a fresh scheme for restricting output. This scheme came nominally into force a few months ago, but so far the production figures issued have not revealed any great sign of its effectiveness, though rumour has it that during June there was a drop in production of several thousand tons. Curiously enough, however, the producing interests concerned selected that period for suppressing the publication of the figures, so that rumour alone is to be relied upon in the absence of definite information. The stock of refined copper in America to-day is probably somewhere about 110,000 tons more or less, and this, while a big quantity, is not really formidable, for it only represents a few weeks' world consumption, and the reserves of metal held elsewhere are not of any importance. There is no doubt, too, that copper at to-day's figure is very moderately priced, and that a good many mines cannot make ends meet. In addition, therefore, to the voluntary restriction of production in force, there has been, and still

is, a certain amount of forced curtailment, and the most has been made of this from a market point of view, even though values have not responded accordingly. Another point, too, is that one of the big South American properties in Peru has just been compelled by the Government of that country to curtail its output by 75 per cent. on account of the damage caused to the adjacent agricultural interests by the emission of fumes and smoke from its smelter, and it will take a year or more to alter the plant so as to prevent this trouble. The loss of 35,000 to 40,000 tons of rough copper a year from this source will naturally help the efforts towards restriction, and will eventually tell upon the output of refined copper in the United States, where this rough metal is treated. As against this, there are proprietors, such as the big Congo producers, who are steadily raising their production, while, too, in the Lake Superior district of North America, development work is being pushed forward with remarkable activity. There is, as we have said, no reason whatever to fear a famine in copper, but higher prices will certainly obtain if Europe settles down to work, and when American trade, which has been distinctly reactionary for some months past, turns the corner and begins to improve. Big electrical schemes are being planned all over the world, involving the consumption of vast quantities of copper, but none of these can develop over-night into market factors, and it must be remembered also that as and when prices improve, the ban on production will be removed by degrees and output will respond accordingly.

Industrial Conditions.

THE operations of the Industrial Welfare Society are deserving of the highest commendation. For the past six years it has been engaged in spreading amongst employers the humaneness and the economic value of industrial welfare work, and to-day more than a thousand concerns have in being schemes of the kind for ensuring the safety, health and comfort of the worker. The Society has now collected the opinions of representative authorities connected with some of these works, and has brought them together in a pamphlet. The general consensus of view is that welfare work, when carried out on reasonable lines (not as one writer puts it, in the "nature of wet-nursing") produces excellent results. Humane and reasonable management is found to encourage loyalty among staffs; to reduce losses from absenteeism, irregular attendance, continual changes in staff, sickness, accidents, and so forth; and to foster a better spirit between managements and employés so that many grievances may be either anticipated or checked at source and so prevented from developing into wasteful disputes. The views of representatives of several well-known electrical and allied manufacturing companies are printed in the pamphlet, and the wisdom of adopting such schemes is recommended to employers and employés in businesses where no organised efforts have hitherto been made. Some idea of the part that has been played by the Society in securing the success of the movement may be gained from the statement that its staff has made over 12,000 visits during the last five years. In its future efforts it will be guided, as in the past, by the conviction that industrial welfare is not philanthropy; it is at once a sign of good management, is economically sound, and is designed to produce those better conditions which employés in industry are entitled to enjoy, though they never can be so enjoyed unless through the conjoint efforts of the employé and the employer.

Trade Conditions in Norway.

THE report of Mr. C. L. Paus, Commercial Secretary at Christiania, upon conditions in Norway, which we review in its application particularly to electrical industry in this issue, reminds us that even the non-combatant countries are still feeling the effects of the European cataclysm.

As in most other European countries (and not European countries alone), financial stringency and labour disputes have retarded progress towards complete recovery. It is satisfactory to note, however, that such movement as was made was in a forward direction, and in many instances substantial improvement is recorded. Both inward and outward foreign trade advanced, although the balance remained at about the same level in favour of imports.

The development of the country's immense water-power resources continued, but no new work was commenced. Several schemes arrived at completion, and a number of others will be ready for service at an early date. A plan for the co-ordination of electricity supply has been produced by a special Commission, which recommends public administration under State control; it is not proposed to interfere with the production of power by private concerns or persons for (apparently) their own use.

The technical difficulties in the way of the exportation of power to Denmark are said to have been surmounted, but the financial difficulties remain and will lead to an indefinite postponement of the project.

Manufacturing costs appear to be so high as to nullify to a great extent the effect of the special protective tariffs. This circumstance, combined with the weakening of German and other European competition by rising internal prices, renders the market easier of access to British manufacturers. Against this, the efforts towards economy, stimulated by financial conditions, will probably lead to the reduction of purchases to a minimum. However, there are many things which *must* be purchased, and electrical equipment is surely one of these.

The British Association.

THE ninety-fourth year of the British Association for the Advancement of Science found its members assembled in Toronto for the second time in 27 years. If the figure showing the number present is any indication, the attendance of 4,000 or more surely means that the meeting was an unqualified success. The programme of papers read before the thirteen sections equalled in bulk any of those presented to earlier meetings and, as usual, a number of controversial subjects were discussed. A continually-growing feature of the meetings is the Psychological Section, in which the actions of the human mind are studied in their bearing upon different industries and other phases of activity. Consideration was given, as in previous years, to the co-ordination of mind and muscle to produce work with a minimum waste of energy, and various views upon this subject were expressed by well-known exponents of industrial psychology. In the Physics Section further advances in the study of the structure of matter were announced by Sir Ernest Rutherford and Sir W. H. Bragg. The former, in a lecture to the Toronto Rotary Club, intimated that the new discoveries might find application in the manufacture of steel, and might even revolutionise steel-making. The president of the Economics Section examined the Free Trade doctrine with results not altogether favourable to that creed.

In the Engineering Section, electrical engineering was worthily represented by Prof. G. W. O. Howe, who, as president, addressed the Section on "A Hundred Years of Electrical Engineering." This was necessarily an abbreviated account of all that had been done in the time, and naturally the last fifty years or so received most attention. The speaker showed very successfully how the object of a cheap and efficient form of power had been assiduously pursued, turning now and again to developments in other directions—telegraphy, with and without wires, radiology, and lighting—and leading up to references to the latest power-plant achievements. The conclusion of the address was a simple statement of a well-known view:—"In no branch of electrical engineering, however, is there any suggestion of having reached finality; on the contrary, rapid development is taking place in every direction, and we can look forward with confidence to an ever-increasing application of electricity to the utilisation and distribution of the natural sources of energy for the benefit of mankind."

The World Power Conference at the British Empire Exhibition.

(Continued from page 206.)

Internal-combustion Turbine Prospects.

On July 8th, in the Internal Combustion Engine Section in Hall II, a very interesting discussion followed the presentation of the various papers. Mr. R. Pochobradsky, of the Fraser & Chalmers Engineering Works (General Electric Co., Ltd., London), in commenting on Mr. Richardson's views with regard to the outlook for the internal-combustion turbine, considered that the new steel which Sir Robert Hadfield had recently described, foreshadowed that many of the difficulties hitherto experienced would be overcome; in particular, the fact that the metal was not affected by the great heat of the exhaust gases, would enable a higher degree of compression pressure to be adopted. The internal-combustion turbine was not to be disregarded because it might not reach the efficiency of the steam turbine; the all-round economy, the initial and maintenance costs, &c., were factors which, if taken into consideration, gave a more optimistic outlook for the internal-combustion turbine. As for Diesel engines, good work was being done in the injection of high-pressure steam in place of air.

Mr. H. J. Gibbons, of the Premier Gas Engine Co., Ltd., drew attention to the difference between British and Continental gas-engine practice. Whereas the initial work on producer gas was started in this country, blast-furnace gas utilisation was first taken up on the Continent. In the competition with the steam turbine, internal-combustion engineers would need to devote more attention to increasing the thermal efficiency of their products. He did not, however, think that the desired economy would be obtained by means of internal-combustion turbines.

Mr. A. H. Lymn (London) was, however, more optimistic regarding the future of the internal-combustion turbine, and mentioned that one of 5,000 h.p. had been constructed in Germany, the thermal efficiency of which was expected to ultimately attain 29 per cent.; in fact, the makers were prepared to supply such prime movers under the same guarantees as steam turbines.

Mr. J. L. Chaloner (London) considered that high compression oil engines of high powers were only at the commencement of development, and in this connection he considered that the experience of the gas-engine world was worthy of being drawn upon. Too much attention should not be given to high pressure, for although this might mean efficiency, it did not follow that it gave all-round economy and reliability. Theory was one thing, but in practice they had to contend with frequent changes in the quality of the liquid fuel available, the tendency being always towards the use of heavier grades.

Mr. Herbert A. D. Ackland, M.Inst.M.E., after giving some interesting details of the results obtained from the Still engine as applied to marine work, agreed with the view that efficiency as measured by b.h.p. was not the only point in connection with internal-combustion engine development. Prime cost, wear and tear, maintenance, weight, and space occupied were all equally important factors.

Mr. F. H. Clough, of the British Thomson-Houston Co., Ltd., expressed disappointment with the low speeds of internal-combustion engines, and pointed out that if such prime movers capable of running at high speed were available, there would be more opportunity for their utilisation for electrical work in distributing power at great distances, and in other directions. He thought this was possible at the sacrifice of but a slight drop in efficiency.

Prof. R. E. Mathot (Belgium) stated, however, that, although he had experimented in this direction, he had been extremely disappointed with the results.

The Importance of Research.

In opening the session devoted to Research in Hall III, on the afternoon of July 8th, Dr. A. E. Kennelly, who presided, commented on the need for encouraging activities at the present time in order to ensure further progress and development. He also emphasised the desirability of greater intercourse between research workers, and regretted that, owing to lack of confidence, many refrained from making known the results they had attained, whereas, if the opposite plan were adopted, just the desired clue to further progress might be forthcoming. Four papers were before the session, one dealing with the laboratories for research work in Austria, and one by Dr. A. F. Enström on "The Organisation of Research Work in Sweden." This is carried on by the Swedish Institution of Scientific and Industrial Research, which, although not a State body, enjoys the benefit of Government moral and financial support. The work in hand embraces a study of the properties of fuels, an investigation into conditions when a centralised combined generation of power and heat is an economic proposition, and research as to the possibilities of using electric energy for heating purposes to the best advantage, standard electric transformers, and electric furnace materials.

In the ensuing discussion, Mr. C. C. Paterson, director of the General Electric Co.'s laboratory at Wembley, supported the view as to the need for closer contact between research workers. In his opinion there was no question of overlapping; on the other hand, with many workers in the same field, and the dissemination of the results achieved, each was able to obtain information which acted as a means of checking his own particular data.

Private Laboratory Work in America.

Mr. C. E. Skinner, head of the laboratories of the Westinghouse Electric Co., Ltd., Pittsburgh, stated that the war had stimulated research work in the United States where, in addition to many laboratories connected with private undertakings, they had now several Government institutions. While the latter were doing valuable work, he thought their greatest field lay in stimulating research work rather than in performing investigation themselves. With regard to research work in private undertakings, difficulties had been encountered in inducing boards of directors to set aside the necessary financial appropriations, but the valuable work that had been done in the laboratories had resulted in such installations being more widely supported and their importance better appreciated. His experience was that "the scientific accomplishment of to-day becomes the background of the industrial development of to-morrow." As an instance of the value of research, he mentioned the occasion when need arose for greater knowledge on the production and maintenance of vacuum, a branch which, once taken in hand, quickly resulted in much valuable information. Laboratory work, in his opinion, could be divided into three stages: (1) proving the principle; (2) getting out a suggested design; (3) developing the design into a commercial or marketable product. With regard to the proposal for more co-operation between research workers, he considered that, while this was desirable, its field was more in connection with fundamental work. In detail experiments the question of patent rights had to be taken into consideration even in this direction; however, he was glad to find that industrial firms were taking a wider view.

Sir Frank Heath, secretary of the British Government Department of Scientific and Industrial Research, doubted whether it was worth while to devote attention to the question under what ægis research work was car-

ried on in other countries, each of which had its own conditions to take into account. The great thing was that research work should be carried on—whether by State support or private enterprise, the aim was the same. There had been proposals for the establishment of an office for the dissemination of research work results to private undertakings and to other countries. In his opinion, this was not desirable. What was wanted was more direct intercourse between research workers. This should first be done on a national basis, and when this was accomplished it would be possible to endeavour to link up internationally. Another important matter in connection with research work was that of providing promising men of advancing age with opportunities to exercise their capabilities in a practical manner, his experience being that such men were not content to work long in merely an advisory capacity.

In describing the methods adopted in America, Dr. Brooks, of the United States Bureau of Mines, mentioned that there was a regular interchange of visits between the leading workers in the Fuel Research Departments of Great Britain and the United States.

The Reward of Research and Invention.

Capt. G. A. Taylor (Sydney) drew attention to the necessity for a more practical, *i.e.*, financial, appreciation of the work of pioneers and inventors. In this connection he was glad to see that a report by the Committee of Intellectual Co-operation had been presented to the League of Nations approving the principle that the authors of discoveries and inventions should be protected and rewarded. In Australia they had an Inventions Encouragement Board, founded in 1922, the object of which, among other things, was to examine inventions as to their practicability and scientific soundness, and to assist financially and advise inventors in their application and use in order to benefit both the nation and the inventor.

Electro-Aeronautic Research Work.

In a paper on this subject by Herr. O. Taussig, of Vienna, the author described a new and valuable field for useful work by airships and aeroplanes—that of locating underground water supplies and ores of high electric conductivity, such as magnetic pyrites, magnetite, molybdenite, and certain copper ores. The method, which it is claimed will be of great importance in that it will enable arid countries to be turned into fertile lands, is founded on the principle of exciting electrical oscillations in an electrical conductor or antenna, and of measuring the duration of the oscillations. Two such methods have been worked out by Dr. Heinrich Lowy—the capacity and the reflection—both of which have already given good results in experiments carried out on both a Zeppelin airship and aeroplanes. The methods were patented, but Herr Taussig announced that both the British and American Governments were already showing great interest in the idea.

Prof. Glouchkow, of Leningrad, and Prof. Ramsin, of Moscow, gave some particulars of the research work which is being carried on in Russia, from which it is evident that the Government of that country fully realises the importance of the work. Prof. Glouchkow dealt more particularly with the study of water power utilisation, while Prof. Ramsin was in charge of fuel research, having six different types of boilers at his disposal in which to conduct tests of various classes of coal for steam-raising purposes.

In closing the session, Dr. Kennelly drew attention to the need for an appreciation of the research workers who had preceded the present generation, and in this connection drew attention to the great benefit to the electrical industry by past work in high-conductivity copper which, once unknown and unobtainable, had become a standard product.

Electricity in Domestic Use and Agriculture.

Four papers—from Great Britain, Germany, Sweden, and Switzerland respectively—were presented to the session in Hall I on the morning of Wednesday, July 9th, devoted to the subject of Electricity in Domestic Use and Agriculture, over which Mr. J. Bache-Wiig, director of the Elektrisk Bureau, Christiania, presided. The first paper was that on Electro-Farming Economics, by Mr. R. Borlase Matthews, who, in addition to being a member of the Institution of Electrical Engineers, runs an electrically-operated farm of 600 acres at East Grinstead. Deploring the fact that, despite continually improving agricultural machinery, there was a distinct tendency on the part of both farmers and their men to rely more on manual effort than on means which economised labour, Mr. Matthews demonstrated by figures that not only was the adoption of electricity for farming work a profitable proposition, but that he could afford to pay a comparatively high price for electrical energy, the ratio of the latter, at 10d. per kWh, being as 1 for electricity to 2.3 for heavy-oil tractors and 4 for horse (animal) power, leaving out of consideration the question of improved efficiency. On the other hand, it was equally possible for electricity supply authorities to give a supply to farmers on a profitable commercial basis. As examples of the value of electric lighting and power in farm work, attention was drawn to egg production and cattle feeding in winter, haymaking without sunshine, increased crops by electroculture, improved water supply, ploughing, &c. In agricultural districts there were many profitable openings for enterprise on the part of electricity supply undertakings. In the poultry and egg industry he instanced one farm where the annual consumption of energy was equal to that of an engineering works with a total installation of motors of 450 h.p. Further opportunities for electricity supply in country districts lay in the development of rural industries as a corollary to farming operations.

Following an exhaustive outline of the opportunities for both farmers and electricity undertakings, Mr. Matthews gave useful diagrams of load curves for rural electricity distribution and the supply networks necessary therefor, supplementing these with information as to transformer towers and other apparatus. Line installation costs per mile, wayleaves, and other problems were thoroughly gone into, and finally Mr. Matthews urged the need for an educational campaign to extend the use of electricity for agricultural purposes, and by way of encouraging supply authorities, expressed the view that it would be found much easier to persuade farmers to take a supply of electricity from public mains than most engineers imagined. As further encouragement, he mentioned that in Sweden there were over 52,000 electrically-equipped farms, notwithstanding that the charge for supply was higher than in most large English towns. In the early stages it was advisable only to attempt to supply farming districts where at least one-fourth of the land was arable. In all cases, however, estimates should be based on the length of the route and not on the area of the territory.

Electric Rotary Land Tillage in Germany.

Dr. H. Wallem (Germany), in his paper on Electricity in Agriculture, while covering the whole subject, dealt particularly with electric rotary tillers, which were meeting with greater favour in Germany than electric tractor ploughs, as it was found that, owing to the better opening up of the soil, greater air and rain penetration resulted, giving an increased crop yield of 10 per cent. He also referred at some length to the subject of the application of electricity for the preservation of green fodder for the winter by means of electric ensilage installations.

Swedish Electro-Farming Progress.

In the absence of the author, Mr. Matthews gave an abstract of the paper on this subject by Mr. Nils Ekwall, the rural electrification expert of the Swedish Department of Agriculture, from which it appeared that the electrification of farms had made unprecedented progress in the last ten years. It is estimated that 37 million out of a total of 94 million acres of arable land,

or about 40 per cent., are now electrified. The installed load of electric lamps, motors, and other apparatus in connection with Swedish farms amounted at the present time to a total of about 260,000 kW, and the annual consumption to 120,000,000 kWh. It was calculated that at the present rate of progress the demand for current for farming purposes in Sweden would within 20 years amount to nearly 400,000,000 kWh.

Domestic Electrical Progress in Switzerland.

M O. Ganguillet, in his paper, referred to the great progress in the use of electricity for domestic purposes, particularly for heating and cooking. It was estimated, he stated, that there was in use in Switzerland about one electric iron per 10 inhabitants, using a total of 30 million kWh per year, while electric cooking was responsible for an annual consumption of from 80 to 100 million kWh.

In the subsequent discussion, Mr. F. Holmgren (Sweden) drew attention to some of the directions in which improvements were necessary in the adoption of electricity for farm work. At present every farm had to have its own transformer, the size of which was determined by the kVA of the threshing motor at full load. He advocated the use of a compensated motor running at unity power factor, which would enable smaller transformers to be used, and so reduce copper and core losses. Mr. G. R. F. Nuttall gave some particulars of the work which is being done in Northern France, where farms are being linked up to 45,000/15,000-V transformer stations, small transformers being used on the farms. Mr. Alf. Ekstrom (Sweden) recommended that electricity supply to farms was more a matter for private supply companies than for Government undertakings. A problem which required attention was that of the insulation of the wiring of cowsheds to prevent it being detrimentally affected by ammonia gases.

Electro-Farming in California.

Mr. R. Sibley, one of the American delegates, gave a short account of the progress of electro-farming in California, which was responsible last year for a consumption of 650 million kW. The power stations over a distance of 1,400 miles were all linked up and connections were made to farming areas from the main transmission lines between the power stations and the big receiving-distribution centres on a "50-50" basis, the cost being borne equally by the supply concerns and the consumers. Electricity was being employed in all classes of farming and fruit growing and canning work and also with great success in poultry raising and egg production. Mr. Sibley also gave some useful information of the amount of current taken by various branches and of the size of motors used.

Co-operative Installation in Sweden.

Mr. S. Velander, chief engineer of the South Sweden Power Co., supported Mr. Matthews in his view that rural industries would be developed in electrified farm areas. The principle of his company was to establish, at its own cost, 20,000-V distribution lines and small transformer stations, and then get farmers to form a co-operative society to defray the cost of 1,500-V lines which, when erected, were handed over to the power company and maintained by it at an annual charge of 40 per cent. The cost of this installation and annual charge was shared by the co-operative society members in proportion to their consumption. The latter was charged for to each separate user at two rates—a little below 3d. per kWh between daybreak and 10 p.m. and slightly over 1d. for the remainder of the 24 hours.

Power in Electrochemistry.

In Hall II on Wednesday morning, July 9th, half-a-dozen papers were presented, but the whole affair was disappointing. There were but a handful of people present, and everything was finished in less than an hour. The chairman was Mr. H. Horn (Norway); he did his best to beat up a discussion, and succeeded in doing so to a certain extent. The papers dealt with the electrochemical industries in Austria; nitrogen fixation; the electrochemical industries in Sweden; a new resistance furnace with reaction zone; power in electrochemical and electrothermal industries, and, finally, small water powers and electrothermal and electrochemical loads. Most of them were of a general survey character, but special attention may be directed to the paper by Mr. Boex (Great Britain) dealing with small waterpowers. Mr. Boex is specially interested in Scotland, and he charged industrial concerns in this country with being at fault in thinking only of large water powers, and not of the small ones, as a means of developing electrothermal and electrochemical loads. He urged that attention should be directed to the small water powers which are found so frequently in Scotland.

As an addition to the general survey, there was some information forthcoming as to the position in Canada, where water power as a means of extending electrochemical and similar industries has been developed to a very considerable extent. Here, again, the information was of the character which is to be found in literature, and did not deal with technical processes. In a similar way, in the absence of a paper on the general subject from France, M. Dieny, representing that country, spoke of the manner in which the electrochemical and electrometallurgical industries were being developed there. In some districts in France there were small water powers which could only be developed if electrochemical processes were worked, on account of the purely agricultural character of the neighbourhoods.

(To be continued.)

The Costing of Winding and Insulating Coils.—I.

By F. C. LAWRENCE, M.C., B.Sc.Tech., A.M.I.E.E., A.C.W.A., Chartered Electrical Engineer.

The manufacture of coils for electrical machinery, transformers and meters involves, at every point, the use of such small quantities of labour and materials, that the costing of the coils with any degree of accuracy is a problem which requires considerable care.

The final assembly of the machines or apparatus, after the various components have been made, is a process which lends itself to a comparatively simple method of costing, and when one speaks of electrical engineering costing, one is apt to forget the first processes which are necessary, such as the manufacture of the coils, and to think that one method of costing is applicable to all functions of a factory.

The cost of coils and insulation will be found to account for a considerable proportion of the cost of manufacture of the finished goods. Expensive materials are used, for example, copper, varnish, mica and silk, and a large number of processes are often necessary to complete the coils, so that it is often the case that the cost of the coils of a motor represents over 20 per cent. of the factory cost of the finished machine, while in the case of transformers the proportion ascends to as much as 40 per cent. To arrive at "costs" which are, for for the most part, guesswork, or which are lacking in accuracy, is therefore to bring discredit upon the costs of the whole machines or apparatus; but, on the other hand, since so many small items of cost have to be collected and allocated to the cost of individual

orders or jobs, the amount of clerical labour necessary to ensure accuracy in both shops and offices becomes excessive, if the ordinary methods of costing, employed in the case of fitting and assembling, are utilised. For this reason certain expedients have to be employed which will cut down the clerical labour but still retain the accuracy, which, at first sight, might appear impossible of attainment, except by means of such great detail in the compilation of the costs.

This treatise is intended to apply to an electrical firm which makes its own insulating materials and coils, besides manufacturing the motors, transformers, &c., but the systems evolved will be equally suitable to a firm which confines its activities to the manufacture of coils and insulating materials.

It is as well to indicate some of the methods already in operation in many factories, and to point out the reasons why they are not entirely successful, before proceeding to enunciate the methods which are deemed to give the maximum accuracy obtainable without a vast amount of clerical labour.

Present Methods.

In the manufacture of transformers, a large number of fullerboard and fibre washers and blocks, of all sorts of shapes and sizes, are required—every different type of transformer requiring washers and blocks of different dimensions. They require marking out, sawing or stamping, boiling in oil, and milling, guillotining or grinding. The cutting out of the washers leaves a large quantity of scrap, which may or may not be used again on small jobs, so that the requisitioning of raw materials and crediting of scrap would involve a tremendous amount of writing, which would be a hindrance rather than a help to production.

The amount of time spent by each operative on any one order may be of quite measurable quantity, but often, for small sizes and orders for small numbers, only five minutes or less is required on each operation and, whilst the time-booking involved would be beyond human patience, the accuracy obtained in the booking of such short times is always questionable, commonly including errors of 200-300 per cent. In a transformer, for instance, there may be many such amounts and the total error then becomes a serious matter.

Often enough, what requisitioning and time-booking is done becomes valueless, because the costs charged out are based upon estimates or the results of periodic "tests." Alternatively, they are composed partially of bookings and partially of estimates. Either of these methods may form a sufficiently accurate basis for price fixing, but, as a means of control of efficiency and waste, they lack the first essentials, for they provide no check on actual performances.

The impregnation of field coils with varnishes and gums presents equal difficulties, from the costing point of view. Where large numbers of coils are treated daily, it is impracticable to impose a system of weighing each coil before and after treatment, in order to arrive at the weight of varnish absorbed. Even if this were done an addition would have to be made to the cost, to take care of the wastage, an expedient liable to detract considerably from the accuracy obtained by such careful weighing.

The building-up of mica products on paper, silk, cambric, &c., is another process which calls for the use of small quantities of labour and materials, and the work of allocation to individual orders would never justify the cost results.

As a last example may be taken the assembly of small field coils. Small pieces of tape of various kinds, empire cloth, washers, sheets, &c., are necessary for each coil. These are not required in sufficient quantity to justify their separate issue from stock, so that rolls of tape, large sheets of paper, and large quantities of washers are withdrawn and kept on the benches, ready for any jobs that come along.

Such a practice does away with any hope of costing the actual materials used on each job, and the costs must in the circumstances be largely hypothetical.

The Problem Analysed.

Before describing the suggested methods of procedure it will be convenient to divide the activities of the coil department into its natural categories.

The first processes to be considered are those which deal with the preparation of basic materials; namely, the insulating materials such as varnishes, mica products, shaped fullerboard and fibre and products of a like nature, and the main material, copper wire and bars, either silk covered, cotton covered or bare, which are bent to shape or wound into coils. Secondly, there are the insulating, varnishing, assembling and impregnating processes, and lastly, the test and inspection.

In discussing the methods of costing, the question of factory overhead expenses is purposely omitted at this stage, as it is better dealt with as a separate item.

In the normal course of production, the products of manufacture can be roughly divided into standard types and special types. There are so many special types of coils and of insulation, that it cannot be presumed to deal with all of them. This treatise is largely confined to what may be termed standard types; but it will not be a matter of great difficulty to extend the systems described to cover special cases, which will not usually form more than a very small proportion of the whole output.

It is taken for granted that the manufacture of the various component materials and parts is sectionalised in the factory, that is, all the mica-varnish products are made in one part of the shop, impregnation is carried out in another part where all the ovens and tanks are collected together, and so on.

It is necessary to appreciate the difficulties to be met by the engineer and cost accountant in facing the problem, in order that the expedients suggested for adoption may be justified and the reason for their use made clear, and it is of importance to realise the distinction between the two main methods of costing in engineering factories, so that their respective limitations may be appreciated.

Job and Process Costing.

When an order calls for a whole machine or piece of apparatus, if it is not usually difficult to book the majority of the labour and material used in its manufacture directly to the job, and from these bookings to arrive at the individual cost of the product, but quite a large proportion of the work done in an engineering factory does not lend itself to this individual treatment. Included in the assembly of most articles are parts which, in their own process of manufacture, have no distinct entity. They form but a part of the products made in bulk in the early stages. The manufacture of insulating materials comprises many processes which are continuous in their nature and the manufacture of the pieces for any one job is not distinguishable from that of pieces, for other jobs, being made at the same time.

This method of manufacture gives rise to the necessity for process costing. The processes to be costed proceed day after day and result in a cumulative output of pieces, pounds, yards, or other units of the product.

The chemical, oil refining, and soap industries provide instances where the chief method of costing is by process.

In such cases and in the cases already cited, in connection with the manufacture of insulating materials, the processes may be costed each week, month or other period. Stated generally, the method consists in collecting all the charges which make up the cost of the process for a definite period, and dividing the total cost by the output of that period in suitable units, so as to arrive at the cost per unit produced. Every unit made during the period bears that unit cost.

In applying a process costing system, the first step is to define the process period. This having been decided, a number is allocated to each process, whilst a sub-number is introduced to distinguish the periods: for instance, for monthly processes, sub-number 1, for each

process, might refer to January, sub-number 2 to February, &c.

The booking and accounting of all labour and material to its respective process numbers leads, with the addition of overhead expenses, to the total factory cost of each process for the period concerned.

The output from each process being known, it is a matter of no difficulty to determine the cost per unit output, at which figure the product may be charged out to the storeroom or to the cost of assembly of the apparatus on which it is used. The result is that the final costs of every product of the factory will contain the true cost of the material received from any of the processes, with the minimum expenditure of clerical labour for costing.

(To be continued.)

Change-over Oil-immersed Draw-out Switchgear.

AN interesting type of ironclad switchboard was recently designed and manufactured by the General Electric Co., Ltd., which should appeal particularly to engineers desiring to install this class of gear in connection with schemes dependent upon two separate sources of supply. The apparatus was made to the order of the Imperial Tobacco Co. (of Great Britain and Ireland), Ltd., in connection with their Ogden Branch, Liverpool.

The board is mainly composed of pedestal type flameproof draw-out units, embodying a special change-over circuit breaker and steel plate cubicles of standard design. It is designed for use on a 400-V, 3-phase, 50-cycle supply and consists of two pedestal draw-out oil circuit breakers for controlling 400-kVA alternators, one isolating cubicle, one incoming cubicle for a 1,400-kVA Corporation feeder, and six change-over type pedestal draw-out oil circuit breakers for the feeders of the distribution system. The change-over mechanism of the feeder oil circuit breakers, a typical unit of which is seen in fig. 1, is extremely simple and reliable. The contacts are

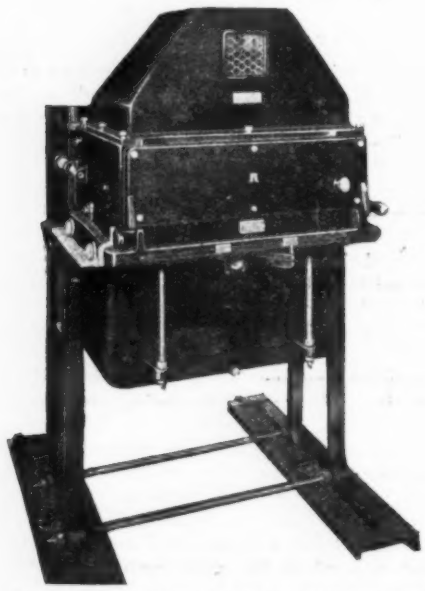

Fig. 1.—Draw-out Pedestal Type, Change-over Oil Circuit Breaker Unit.

arranged so that current may be obtained from either set of bus bars. To this end three sets of stationary plug contacts are supplied per phase instead of two, as in the ordinary draw-out type oil circuit breaker. The upper set of contacts is connected to the feeder, while the two sets of lower contacts are connected to the company's supply and to the Corporation supply respectively. The selection of the supply is accomplished by rotation of the moving contact bars to register with either of the two sets of fixed contacts. The movement is controlled by a lever mounted on the front of each pillar just above the oil tank. This lever will be observed in fig. 2, which shows the breaker carriage mounted on the pedestal with the oil tank lowered so that details may be observed of the fixed and moving contacts in the tank. It will be noticed that although the moving contacts are almost identical with those mounted in the standard pedestal the stationary contacts consist of four sets per phase instead of two as usually supplied. Two sets of contacts are electrically connected and mounted on the line side of the oil circuit breaker. The two remaining sets of contacts are mounted as in the ordinary circuit breaker, one set being connected to each set of bus bars. Should it be desired to switch the feeder from one supply to another it is only necessary to trip the breaker and turn the operating lever from the Corporation supply to the company supply, or *vice versa*, as indicated by the labels and reclose the breaker. To prevent the closing

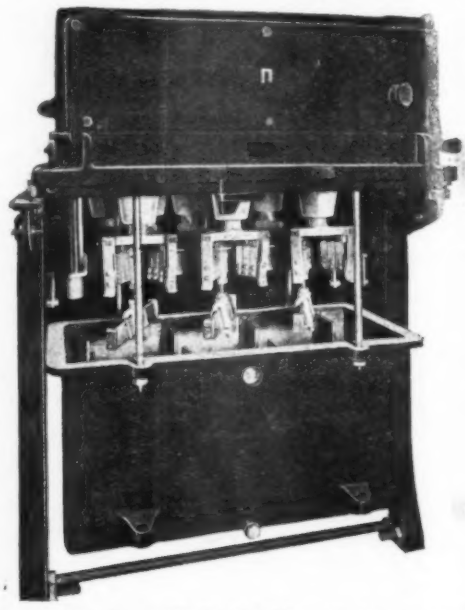

Fig. 2.—Change-over Oil Circuit Breaker. Tank lowered to show Contacts.

of the breaker with the lever handle in an intermediate position, a mechanical interlock is introduced.

These change-over type oil circuit breakers have all the salient features of the G.E.C. single-throw pedestal type breakers. They are suitable for heavy operation and are supplied with broad machined joints for flame-proof installation. Interlocks are supplied which make it impossible to close the breaker until the plug contacts have made correct contact, and it is impossible to withdraw the breaker carriage until the handle is in the "off" position. The oil tank cannot be lowered until the carriage is withdrawn and must be raised before the carriage can be replaced. The two steel plate cubicles are of the standard G.E.C. pattern.

Salaries of Australian Power Station Officials.—Mr. Forbes Mackay, general manager of the Sydney City Council's Electricity Supply Department, states that, in his opinion, the engineering staff of his department is not properly paid, and that it would pay the City Council handsomely to increase considerably the pay of all the technical engineers employed in the department. These statements were called forth when applications for the position of power house superintendent were under consideration. There were twelve applications for the position recently advertised, but, Mr. Mackay stated, none of the applicants had the qualifications he was looking for, and he did not think the City Council would get a suitable man at the salary of £750, which was what was offered in the advertisements. The superintendent in charge of the Melbourne railway power station was paid a salary of £1,200 a year. The Sydney Council has now decided that the position of power house superintendent shall be re-advertised at a salary of £1,100 per annum.—*Industrial Australian and Mining Standard.*

A Large Battery Locomotive.—A 75-ton storage battery locomotive, which is claimed to be the largest built in the United States, has been put in operation at the Schenectady plant of the General Electric Co. for use on the interconnecting track systems of the plant and for operation in restricted areas where overhead or other methods of current collection are impracticable. This locomotive is a double-truck, four-motor unit with a central operator's cab and batteries arranged in compartments at either end. It is equipped with contactor control and automatic air brake equipment; the battery, which consists of 100 cells, has a total capacity of 1,080 ampere-hours, or 216 kilowatt-hours. The locomotive was built at the Erie plant of the General Electric Co., and may also be operated with a pantograph to collect power from overhead wires, if required.

Electrical Progress in India.

Large Extensions in Karachi.

(FROM A CORRESPONDENT.)

GREAT progress has recently been made in the electrical equipment of Karachi. The extensions to the power house, mains and generating plant of the Karachi Electric Supply Corporation, Ltd., have now been completed, and the two large flywheel-type alternating current generating sets are both in regular operation. The engines are of Messrs. Mirrlees, Bickerton & Day's manufacture, and are of the 750 b.h.p., improved, crosshead type. The flywheel-type alternators are by the Electric Construction Co., Ltd., of Wolverhampton. They are capable of producing 510 kW, and are wound for 6,600 volts, 3-phase, 50 cycles, at 200 r.p.m. The extension switchboard was made by Messrs. Ferguson, Pailin, Ltd., and is of the steel plate cubicle type, the switches, doors and isolating links being automatically locked together.

Three underground cables have been laid to supply high-pressure current to the districts of Keamari, the Old Town and Runchore quarter, and sub-stations have been erected to reduce the voltage to 380-220 for use at consumers' terminals. One of the sub-stations is equipped with a 250-kW Hewittic mercury-vapour rectifier, believed to be the first in use in India. With this extension plant in operation, there should be no difficulty now in meeting all the demands of Karachi for both power and lighting purposes for some considerable time, but further extensions are already under consideration.

The Karachi Electric Supply Corporation, Ltd., was formed in the autumn of 1913, with Sir Montagu de P. Webb, Kt., C.I.E., C.B.E., as chairman. The original generating plant, consisting of two 240-b.h.p. and one 100-b.h.p. Mirrlees-Diesel engines coupled to direct-current generators, was started up on March 31st, 1915. In 1917 the first extension set of 320 b.h.p. was installed and two more similar sized sets were installed in 1920. In 1921, a further 320 b.h.p. set was added and the erection of the present extension sets was commenced in November of last year. The total capacity of the Karachi station is now 3,369 b.h.p., of which total 1,869 b.h.p. is used for the generation of direct current at 460-500 volts, and 1,500 b.h.p. for the generation of alternating current at 6,600 volts.

The growth of the station may be appreciated from the fact that while in 1918 the capacity of the plant was only 386 kW, with 844,140 kWh of energy generated, the capacity to-day is 2,246 kW. In 1923, the capacity was 1,226 kW and 2,719,103 kWh was generated.

Karachi is now the second largest electric power generating station in India which is equipped solely with Diesel engines, the Ahmedabad power station being the largest, with 3,450 b.h.p. of Mirrlees-Diesel engines installed. Messrs. Handcock and Dykes have acted as consulting engineers to the Karachi undertaking since its inception.

Legal.

Neufeldt & Kuhnke v. J. Braham.

In the Vacation Court on August 6th, Mr. Justice Tomlin had before him a motion by plaintiffs in the action by the plaintiffs, of Kiel, Germany, for an injunction to restrain the defendant, of Bishopsgate, E.C., from selling or offering for sale as "N. & K." head-'phones, goods not manufactured by the plaintiffs.

Counsel for the plaintiffs stated that this was a passing-off action, in which it had been arranged that the motion should stand over to the second motion day next sittings, defendant undertaking to keep an account of all the articles in question sold.

Claim Against the London Electric Railway Co.

MR. J. SEAGRAM RICHARDSON (head of the firm of Messrs. Debenham, Tewson & Chinnocks, of Cheapside and St. James's), as umpire, has prepared his award in the form of a special case for the opinion of the High Court on two claims which he recently heard at the Auctioneers' and Estate Agents' Institute (*vide* ELEC. REV., May 30th, p. 874). The claims were made by Mrs. Ada Josephine Coish and Mr. S. T. Smurthwaite against the London Electric Railway Co., and were for £600 and £1,000 respectively on account of injurious affection of Nos. 44 and 46, Golder's Green Crescent, Golder's Green, alleged to be due to the construction by the Electric Railway Co. of a viaduct and bridge in front of the houses.

In the case of Mrs. Coish, the umpire states:—"(1) The question for the opinion of the Court is whether, on the facts stated, I am right in law in holding that the injurious affection complained of is not loss or damage in respect of which the claimant is entitled to any compensation under the said Acts. If the Court is of opinion that I am right in law in so holding, this award is to stand. (2) If the Court is of opinion that I am wrong in law and that the claimant is entitled to compensation in respect of any of the matters complained of, then I award and determine that the amount of compensation to which she is entitled is, in respect of (1), diminution of light and air, £125; (2) loss of privacy, £25; (3) loss of amenities, £350. Subject to this special case I award and determine that there is not lawful loss or damage."

In the case of Mr. Smurthwaite, the umpire puts the question in identical terms, and, in the alternative award, states compensation thus:—(1) Diminution of light and air, £175; (2) loss of privacy, £45; and (3) loss of amenities, £655.

Evidence was given in the case by the claimants, and expert witnesses on their behalf. The railway company contended that no legal claim could be set up under any of the four items for which damage was claimed, namely, loss of light, loss of privacy, loss of amenities, and damage by vibration.

The British L. M. Ericsson Manufacturing Co., Ltd., v. M. Stanley & Co.

MR. JUSTICE TOMLIN, in the Vacation Court on August 6th, heard a motion by plaintiffs in the action brought by them against M. Stanley & Co.

Mr. ELLIS stated that he had to move for an injunction to restrain the defendants from passing off radio head-'phones, not of plaintiffs' manufacture, as the plaintiffs' goods, or from using the name "Ericsson" otherwise than in connection with the plaintiffs' goods. Plaintiffs, added counsel, manufactured a superior kind of head-'phone, which was a most expensive article, and there was a Continental Ericsson head-'phone which was a much cheaper article. It was alleged that defendants had sold some of the Continental head-'phones and had advertised them as of British make. In those circumstances plaintiffs asked for an injunction, and he understood that Mr. Venus, for the defendants, did not offer any objection.

Mr. VENUS said that if plaintiffs would treat the motion as the trial of the action, defendants would consent to an injunction as claimed.

Mr. Ellis agreed, and his Lordship made an order accordingly.

A Consulting Engineer's Claim.

AFTER a nine days' trial, Sheriff-Substitute J. Dean Leslie, in the Stirling Sheriff Court, delivered judgment in an action by Mr. J. E. Schofield, consulting engineer, Huddersfield and Bradford, who sued the Morton Manufacturing Co., Ltd., carpet makers and wool spinners, Cambusbarron, Stirling, for £779 for services rendered by him as consulting engineer employed by the company to advise as to the erection of certain steam, electric power, and lighting equipment at Hayford Mills, and for travelling expenses incurred in connection with the work. A counterclaim for £4,000 was made by the company as damages for the loss which it alleged it had suffered on account of the delay on the part of Mr. Schofield in carrying through the work submitted to him.

The SHERIFF-SUBSTITUTE, in his decision, found that in the preparation of the plans and specifications and in supervising the work which he undertook, Mr. Schofield failed to exercise due diligence and care, though ultimately the work was finished with satisfaction to the Morton Manufacturing Company in respect of skill, and that there was in consequence delay in the completion of the work. His Lordship stated that the customary remuneration of a consulting engineer engaged in work of this nature was 5 per cent. on the cost of the material supplied, plus travelling and out-of-pocket expenses. The cost of the material supplied amounted to £11,990, and 5 per cent. on this sum represented £600. His Lordship found in fact and in law that the pursuer was entitled to the sum of £400, being the said amount under deduction of one-third, and also to the sum of £179 for travelling and other expenses, for which sums he granted decree. He also found that the Morton Manufacturing Company had failed to prove that Mr. Schofield entered into an understanding to have the installation of power plant and lighting in the Hayford Mills completed by the end of December, 1920. He considered that there was delay on the part of both parties, and that the company, in the knowledge that the pursuer was not exercising due diligence in the execution of the work, continued to employ him, and failed to have the work completed as expeditiously as it could have done by putting in charge its permanent engineer, who was competent for that purpose. The company, his Lordship held, had failed to prove that the loss which it claimed to have sustained was due solely to the want of diligence on the part of Mr. Schofield, and it had contributed materially and directly to the delay in the installation. Reviewing the evidence, the Sheriff-Substitute said that Mr. Schofield was a member of the Institution of Electrical Engineers, and committed a breach of the by-laws of that Institution providing that a member should not, without disclosing the fact in writing to his clients, be a director or member of or a shareholder in or act as agent for any contracting or manufacturing company or firm or business with which he might have occasion to deal on behalf of his clients, or have any financial interest in such business. Mr. Schofield was a director of the firm of Mark Shaw & Sons, Ltd., with which he, before June, 1921, placed orders for material for the Morton Company's purposes, and did not at the time of the placing of these orders disclose the fact of his connection with the trading business in writing. For this, it might be, he was amenable to his society, but the rules of the society did not form part of the contract between Schofield and the Morton Company. But, certainly, the Morton Company was entitled to expect that its consulting engineer would not be the medium of orders for goods for his clients being placed with a firm of which he was a director without that fact being disclosed.

Parliamentary.

[By Our Special Parliamentary Reporter.]

Royal Assent.—On August 7th the Royal Assent was accorded to the Post Office (London) Railway Act, the London Traffic Act, the Keighley Corporation (Trolley Vehicles) Order Confirmation Act, the St. Helens Corporation (Trolley Vehicles) Order Confirmation Act, the Londonderry and Lough Swilly Railway Act, the Hastings Corporation Act, the Clyde Valley Electrical Power Act, and the Lanarkshire Hydro-Electric Power Act.

Broadcast News for Ships.—On July 31st Mr. Hartshorn informed Sir J. Nall that special news bulletins were broadcast daily *via* the Oxford Station for reception by ships on behalf of the Marconi and Radio Communication Companies, respectively. In addition, the British Official news messages transmitted thrice daily *via* the Oxford station were picked up by ocean-going steamers when conditions were not unfavourable. The range of the Oxford station was, however, limited, and, although the best arrangements would be made that were possible within the scope of that station, he feared that the difficulties could not be entirely removed until the new Rugby station was working.

The Electrical Trades Dispute.—On August 4th, Mr. Shaw, the Minister of Labour, in reply to Sir K. Wood, said that with regard to the dispute in the electrical industry, he hoped that the meeting arranged for August 15th would lead to a settlement, but it certainly was the intention of the Ministry, should the negotiations break down, to use every effort in conciliation for bringing about a settlement. In any case, it would be the duty of the Ministry to see that the public was informed of all the facts.

Newcastle-Bergen Cable.—On August 4th, Mr. Hartshorn informed Mr. Baker that the Peterhead-Egersund cable, which connects Newcastle and Bergen, was bought in January, 1911, by the British and Norwegian Governments jointly, and the British end of it was worked on behalf of the Post Office by the Great Northern Telegraph Co. The question of taking over the working had recently been examined, and he was informed that in present circumstances the transfer was inadvisable.

A New Zealand Hydro-Electric Scheme.—On August 5th, Mr. Remer asked the Chancellor of the Exchequer whether the Treasury was assisting the New Zealand Government in the development of the Arapuni power scheme; whether he was aware that, under the contract placed with a firm in this country, a foreign sub-contractor would benefit to the extent of £200,000 worth of electrical equipment which might have been ordered in this country; and whether he would take steps to ensure that British credit should not be used to the advantage of foreign manufacturers at the expense of British firms.

Mr. Snowden said that he understood that the Government of New Zealand had been considering an application for a grant under Section 2 of the Trade Facilities Act, 1924, in connection with this scheme, but no application had yet been received by His Majesty's Government. Grants under that Section could be made only in respect of expenditure in this country, and before making them the Treasury must be satisfied *inter alia*, that the proceeds of the loan were to be applied in a manner calculated to promote employment in the United Kingdom.

Stationary Tramcars.—On August 5th, Mr. Bowerman asked the Minister of Transport whether it was the intention of his department to issue regulations similar to those in operation in Glasgow and elsewhere, whereby mechanically-propelled vehicles were not permitted to pass stationary tramcars engaged in putting down passengers.

Mr. Gosling said he had no power to issue regulations similar to those referred to. It would require legislation to enable him to do so, and he was not satisfied that such legislation was desirable.

Electricity Returns.—On August 5th, Mr. Graham White asked the President of the Board of Trade if he would arrange for the publication in the *Board of Trade Journal*, or in any more convenient form, of the statistical returns made by electricity supply companies to the Electricity Commissioners.

Mr. Gosling, who replied, said that for some time past the Commissioners had been engaged in compiling administrative, engineering, and financial statistics relating to electricity supply undertakings in Great Britain. The compilations were now practically complete, and the Commissioners expected to be in a position to publish the statistics within the next month or two.

Railless Trolley Schemes.—On August 5th, Sir Burton Chadwick asked how many schemes of railless trolley cars had been sanctioned within the last 18 months, and in what towns; and whether the working had proved profitable or otherwise.

Mr. Gosling said that last session the Corporations of Bradford, Chesterfield, Maidstone and West Hartlepool were authorised by Parliament to construct new or additional trolley vehicle routes, and of these routes some at West Hartlepool had already been equipped for working. The Rotherham Corporation Bill, which received the Royal Assent on August 1st, empowered the Corporation to extend its previously authorised trolley vehicle routes, and other proposals were before Parliament. Information as to the financial results of working each railless trolley system opened for traffic was contained in the Annual Return of Tramways and Light Railways (Street and Road) and Trackless Trolley Undertakings. The return for 1923-24 would be issued as soon as the returns to be furnished by the undertakings had been received and tabulated.

Radio Communication with India.—On August 7th, Mr. Baker asked the Under Secretary of State for India whether the Marconi Company was negotiating for the control of the Imperial radio stations to be situated in India, and whether, having regard to the importance of these stations in that they would, as relay stations, control the route to Australia, he would advise the Indian Government to own and control these stations.

Mr. Richards said that the Secretary for India had no official information. He had, however, seen Press statements regarding the formation of an Indian Radio Telegraph Company. Invitations to tender for the formation of an Indian Company to erect and work a high-power station were issued in February last, applications being receivable up to August 1st. Certain rights of purchase and control were reserved to Government in the conditions of the tender. The Secretary for India was not at this stage prepared to advise the Government of India to reverse its policy.

"Jamming" by the Leafield Station.—On August 7th, Capt. Bourne asked the Postmaster-General whether he was aware that "jamming" by the Leafield radio station was causing great inconvenience to the users of receiving sets in Oxfordshire, and that, in spite of the installation of an earth-wire, this nuisance was continuing; and whether he would consider replacing the present dynamo control at this station by valve control.

Mr. Hartshorn said he understood that considerable improvement in this respect had recently been effected by certain alterations in the circuit arrangements at the Leafield station, and the possibility of further improvement was being studied by his technical officers. There would be no advantage in this respect in replacing the arc transmitting apparatus by valves.

A North Country Electric Railway.—On August 7th, Mr. J. A. Parkinson replying for Mr. Gosling, informed Mr. Russell that a scheme for the construction of an electric railway between North and South Shields was authorised by Parliament in 1902, but the powers for the construction of the line had lapsed. He was not aware whether it was proposed to apply for fresh powers.

The Adjournment.—Parliament rose on Thursday, August 7th until Tuesday, October 28th, but will reassemble on September 30th if the Irish situation renders this necessary.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

The Inefficiency of Boiling Rings.

Referring to the letter from "Cuisinier" in your issue of August 1st, it may be that your correspondent is one of this company's consumers, and we would like to take the opportunity of pointing out to him that he may hire an electric kettle at any time at a very small rental, which rental includes maintenance and the "loan" of another kettle if at any time it is necessary to call in the hired kettle for repairs.

If he is one of our consumers, he should already be aware of this, as we recommend the use of a self-contained kettle at the time a consumer applies for his cooker, at the subsequent calls of our lady demonstrators, through the post from time to time, and in the advertisements in picture halls, theatres, &c.

Your correspondent touches upon a curious attitude of some persons towards public service supply authorities, and instances the case of a friend who apparently did not take the supply company's advice to use an electric kettle, but who, when advised by a friend *not* of the supply company, listened to the advice and found it good.

"Cuisinier" agrees that an up-to-date cooker with an electric kettle will make electric cooking the only method worthy of consideration, and it would appear that he only requires the electric kettle to make his own equipment complete. As he appears to know more than the average consumer about electrical matters, he will know that he can buy one at no great cost. If he is one of our consumers and will ring us up, we will deliver a kettle to him at once either on sale or hire.

We note your correspondent's statement that electric cooking is falling into grave disfavour in this district. This is the only indication we have received of such disfavour, whereas in our opinion the continually increasing demand for electric cookers from month to month proves an increased popularity.

It is the custom of some supply authorities to charge a rental for their cookers, which includes the supply of a self-contained kettle. Our own view is that it is desirable to allow the consumer the option of hiring a kettle, as many cooker users already have kettles, or prefer to purchase rather than to hire them.

Newcastle-upon-Tyne Electric Supply Co., Ltd.,
W. F. T. PINKNEY,
Engineer, Lighting and Heating Department.

Newcastle-upon-Tyne, *August 6th*, 1924.

Insulating Tape.

The letter from Mr. A. J. Collins in your issue of July 25th has only just come to my notice.

As a large user of insulating tape, Mr. Collins certainly has a grievance, as I am only too well aware; but I do not think that he can permanently overcome the difficulty by the method he suggests. If we, and other reputable manufacturers, supplied by length and guaranteed the length per roll, we should probably find very soon that we were being underquoted by some unscrupulous manufacturer or agent, who would "guarantee" anything to get Mr. Collins's orders. They would know that the buyer cannot so easily check the length as he can the weight.

The buyer in general is to blame for the deterioration of insulating tape. He *will* buy on price alone, and that has induced certain manufacturers (mainly foreign) to make insulating tapes down to a price and not up to a standard.

My company supplies "Henley" tape in rolls of a guaranteed approximate *net weight without wrapping* and of a quality to comply with the stringent War Office specification. The buyer can easily check both on every delivery he receives. A copy of the War Office specification is published in our leaflet No. 259 CR, *re* "Henley" tape, and our price list H. A. gives the length per lb. for different widths.

The remedy is in Mr. Collins's own hands and in the hands of buyers of insulating tapes generally. They should see that they get the quality they want and the weight they pay for, and not jump from one supplier to another every time some small inducement in price is offered to them.

W. T. Henley's Telegraph Works Co., Ltd.,
W. BISHOP, *Sales Manager.*

London, *August 7th*, 1924.

Church Heating.

We shall be extremely obliged if we may appeal through your columns for assistance in the solution of a heating problem. We have been asked to heat a church and schoolroom electrically, the cubical contents of the former being approximately 100,000 cu. ft. and of the latter 10,000 cu. ft. Energy is to be taken during non-lighting hours only and the installation should be so arranged as to act as a heat storage system.

The heating at present is carried out by hot water, the boiler of which has failed. We are at liberty to remove the old boiler, to fix an electrically-heated one in its place, if we choose, and to use the existing hot water pipes. We should prefer, however, to use directly-heated electric heaters built up with heat-absorbing material, such as soapstone, or alternatively heaters arranged as foot warmers, mention of which was made at the I.M.E.A. conference.

We may say that although we have been connected with electric heating for 25 years, we have not come into contact with a problem of this nature that has been successfully solved. We are anxious to prove that it can be done, and if any of your readers have been successful in similar circumstances we shall be very glad of their help.

Smith & Bellhouse,
THOMAS SMITH.

Wolverhampton, *August 7th*, 1924.

The Miners' Lamps Committee.

The abstract of the final report of the above-named committee appearing in your issue of August 1st has induced me to communicate with you and, while fully endorsing many of its findings, submit to you the following facts which I trust may be of interest to you and all who read the report:—

There is now in the hands of a well-known colliery firm a miner's lamp, formerly of the "Vaag" type, of the 4-volt, 2-cell description, which has been replated with an entirely new type of plate. This cell now gives 19.5 ampere-hours at two volts, the partition having been removed and plates of this new type having been fitted. The lamp weighs about 7 lb. complete, acid jelly is used as the electrolyte, and a double-filament 2-volt bulb taking two amperes is used. This, according to the scale mentioned in the report, gives at least 2.3 c.p. While for the moment the exact candle power may be allowed to stand at that, the increased output depends roughly on two factors, *viz.*: (1) size of the plates; (2) quantity of the acid. In such a confined space as a miner's lamp, taking for instance the ordinary circular cell, one plate must, of necessity, have the larger surface area, and to equalise this and obtain a balance the remaining plate must, while being solid, have great porosity. To meet this a negative, constructed under a special process, of a solid cylindrical shape, is fitted centrally, this being of such a nature that its output is in proportion to its cubic content, and not only to its superficial area. There are certain difficulties with an exterior positive, but if construction is adapted to facilitate acid circulation, the above results are obtained, and more so if free acid be employed.

One result of this increased output has been that a double-filament bulb has specially been constructed with the two filaments working in parallel, it being considered better to have two filaments, each of which gives as much light as the normal bulb, than one filament giving twice the normal, for the reason that should one of the two filaments fail, there will still be one in action to carry on with—it being most unusual for both filaments to fail simultaneously in any bulb—so preventing loss in colliery work through filament failure. On the obvious advantage of this increased illumination to miners' sight I will not dwell; the report is clear enough on this point.

In closing these remarks, I should like to suggest that a rubber pad be fitted under every lamp to counteract shocks during the whole period of use, instead of a rubber mat being used in the lamp room only for receiving them.

Lucifer.

August 5th, 1924.

Notes on Electric Lifts.

Since the article on the above subject was written, the annual report of the Chief Inspector of Factories and Workshops for the year 1923, has been issued.

In the tabulated section on hoist accidents, the returns are given as follows:—

Total hoist accidents (fatal and non-fatal) ...	376
Fatal accidents only	24

Whilst the total number of hoist accidents for the year 1923 shows a considerable increase—slightly over 9 per cent.—above that of the previous year 1922, the number of fatal accidents seems to maintain a rather curious level tendency; in 1921 the figure stood at 25, in the following year, 1922, it had dropped to 23, and last year the figure rose to 24.

S. L.

August 2nd, 1924.

Electric Iron Risks.

We are greatly interested in your correspondence columns relative to the above, and as Mr. Berry mentions in your current issue a device manufactured by us and described in the issue of the 4th ult., we feel called upon to reply.

Mr. Berry states that a separate stand does not render an iron foolproof; we agree, but from observation we find that the average housewife will place an iron upon some type of rest, often an inverted dish, sometimes an ordinary cast metal stand; few people will leave a heated iron upon fabric which will immediately scorch. An iron once reaching a high temperature will either crack the dish and fall on the table, or heat the metal stand until the stand chars its way into the table, thus bringing about a similar result.

To place an iron on a stand becomes a habit and should not be classified with the risk of omitting to turn off a switch. Many irons are connected to lampholders from which a lamp is first removed; the switch may be turned off by the user of the iron, who does not always remove the lampholder connection, with the result that the next person entering the room turns on the switch expecting light and (unaware of the iron being in circuit) goes away *leaving the switch on*. Fires have resulted in this way.

With regard to cost, the ironstand equals the cost of an iron, but it must be remembered that our intention is to make the irons in present use safe by an appliance that can be added at any time, whereas a person having an accident with an iron and demanding added protection has the only alternative of scrapping the existing iron and purchasing an automatic iron which is more expensive than a non-automatic type and equals the cost of the automatic ironstand.

The Bullen Auto. Ironstand Association,
A. G. BULLEN.

Carlisle, *August 2nd*, 1924.

It is very interesting to read the response to my letter of the 18th ult. relative to the above. I am surprised to learn that the attached stand was introduced by the American makers of irons; certainly there are many American irons now marketed with separate stands.

I fully agree with Mr. Archer that few people will leave an iron directly on a table without the addition of some type of stand, but my experience is that the attached stand is not in favour owing to the wrist strain mentioned in my original letter. Experience will prove that in order to exert pressure on the ironing work in process, the operative's shoulder takes up a position almost directly above the iron in order to exert the necessary pressure. Now, in that position the wrist is vertical to the iron; in order to place the iron "point uppermost," considerable effort is required to turn the wrist, especially when many such efforts have been made during the period of ironing. It is much easier to lift the iron on to a stand, which most women appear to do.

Admitting that the present attached stands do not cause pressure to be exerted on the iron terminals, there is still the fact that most ironing tables are not level, due to the heat

causing the wood to warp. With most irons the attached rest allows the iron to just about *balance on a level surface*, but with a surface that is not level there is considerable risk of the iron falling forward into a position where it can do damage. To obviate the latter risk I understand that Messrs. Berry's introduced their "Ortosafe" iron, which appears to bear out my contention that the attached stand is not in favour.

With regard to Mr. Burn's letter drawing attention to the need for an "earthing" wire, will he state how to deal with irons having lampholder adaptors, which are intended for use in almost any room in a house?

Geo. Standish.

Liverpool, *August 2nd*, 1924.

[Our reference to broken terminals related to breakage by a fall from the table to the floor. An iron cocked up on end is in a very unstable position, and is upset by the smallest jerk or jolt; if it strikes the floor heel downwards, the stand fails to avert damage.—EDS. ELEC. REV.]

Old Switches.

In order to add to my collection of interesting old switches, I should be glad if anybody could sell me, or lend for photographing, either of the following examples of tumbler switches:—

Voigt & Haeffner.—Underslung type with quick make and break movement, worked with a compression spring between the dolly and the contact arm. Dolly and contact arm both pivoting on a pin through the bridge. This switch is the subject of patent specification No. 11,552, of 1899.

Thames Iron Works, Ltd. (W. H. Flood).—This switch is of practically the same construction as the above, except that the dolly and the contact arm are mounted on separate pivots.

Faraday, patent specification 8,143, May, 1884.—This is, of course, an extremely old switch, and I should imagine is almost the first example known of a tumbler switch. The bottom of the dolly enters as a wedge into two contacts, and has a compression spring for holding the contact arm "on" or "off."

J. B. Tucker.
J. H. TUCKER & Co.

Birmingham, *August 9th*, 1924.

Electricity v. Gas.

As a gas engineer, I am particularly interested in the letter of Mr. L. F. Ryland in your issue of the 8th instant. The queries he raises are easily answered, as follows:—

(1) The thermal efficiency of the average gas works process is 82 per cent., and the thermal efficiency of gas production is 52 per cent.
(2) The ratio of the output of heat into the room (*i.e.* useful output) from a modern gas-fire with a flue, to the total heat supplied in the gas is 75 per cent.
(3) A gas undertaking's charges for gas are regulated so as to give a reasonable return on the capital employed, and have no relation to the charges for electricity in the same district. If gas is sold in the particular district in question at 8½d. per therm, it is because the gas company finds that such a price is a commercial proposition, and one which holds the balance fairly between the shareholders, employés, and consumers.

I trust your readers will accept my assurance that the above figures are actual practical ones and are not in any sense test figures; as a matter of fact, they are exceeded every day in practice. It follows, therefore, that in your correspondent's area one therm of gas can be bought for 8½d. and this expenditure will transfer by means of a modern gas fire 75,000 B.th.u. of useful heat into the room. One unit of electricity can only develop 3,440 B.th.u. and for the same useful duty (even assuming 100 per cent. efficiency for the electric radiators) 75,000/3,440 = 21.8 units will be required, costing 1s. 9.8d. in the electrical way, for what costs 8½d. in the gas way. It is clear, therefore, why gas fires continue to be used in ever increasing quantities, in spite of what appear to be low prices for electricity for heating.

Personally, I have a great admiration for electricity and all that it can do, not less than my admiration for its older competitor—so much so, that, on my advice, my Corporation has now an application for a Special Order before the Electricity Commissioners for the generation of electricity at the gas works, the whole to be run in conjunction with the gas department. The sooner electrical and gas engineers realise that there is plenty of scope for both their products and that neither can completely fill the consumer's requirements, and the sooner electrical engineers realise that a thermal efficiency of 15 per cent. at the consumer's premises is not good enough, the better it will be for the conservation of our greatest national asset—coal—and for the consumer. The duty of the electrical and gas industries is not, in my opinion, to fight each other, so much as to unite in attacking the vicious waste of coal and its by-products which are so essential to the nation. The electrical engineer is not, however, on very safe ground for attacking the use of raw coal in domestic fires and industry, so long as he continues to generate electricity by means of the same destruction of raw coal which he should be trying to combat.

J. R. Bradshaw,
Engineer and Manager.

Corporation Gas and Water Works,
Retford, *August 8th*, 1924.

Electrochemical Utilisation of Surplus Electricity.

I should be much obliged if you, or some of your many readers, could give me information as to any electrochemical process which could be installed at a low capital cost in conjunction with an electricity supply undertaking to absorb surplus energy during off-peak load hours at a low rate.

I believe there is an electrochemical process for the manufacture of nitrates from atmospheric nitrogen, for use as chemical manures, practised, I believe, in Sweden where cheap water power is available. Perhaps some of your readers could give me information?

The proposed site for my works is adjacent to a main line with excellent rail facilities and a natural water supply. It is in the centre of an agricultural district. Any electrical process producing a saleable product would do. Considerable quantities of clean hot water would be available, if necessary, and 3-phase electricity at approximately 0.8d. for off-peak load hours. Cheap land for factory sites is available.

H. Wilson.

Ashford, Kent.
August 5th, 1924.

[Attention was drawn to this subject in our leaderette of April 18th, 1924, p. 602, in which a number of suggestions were made. Far too little consideration is given to the importance of levelling the load curve by direct action on the part of electricity supply managers, and we are pleased to see that our correspondent is alive to the possibilities in this sense. The views of readers on the subject would be welcome. —EDS., ELEC. REV.]

Maximum Potential Gradients.

I will be greatly obliged if you will insert the following correction to an obvious slip which appeared in my letter published in your issue of July 25th.

The diameter of the cable "over the lead" should have been given as 4⅛ inches (not 5⅛ inches).

A. M. Taylor,
Major S.O.2.

Fowey, *August 4th*, 1924.

The Retail Wireless Trade.

I wish to add my observations to those of your last week's contributor, Mr. Perkins, on the subject of wireless retailing.

There is no question about it; the branch of wireless engineering covering broadcasting reception has been placed in an absolutely ridiculous position, out of all proportion to the transmitting side of the industry.

In the first place, I think the ELECTRICAL REVIEW is to be congratulated on not having joined the ranks of the daily papers which tell the world and his wife all about wireless receiver construction. I have noticed in both morning and evening papers, which have a tremendous circulation, illustrations of receiving circuits, and full descriptive matter appertaining to the same, to enable the veriest ignoramus of electrical matters to construct a receiving set equal to a set bought through an electrical engineer, or a *bona-fide* dealer in electrical apparatus.

It is, I suppose, an impossibility to attempt to estimate the quantity of component parts of receiving apparatus which has been unloaded on to the public, but it would not be so difficult to estimate the likely number of sets constructed by amateurs which are correctly designed, and operating efficiently. I put it at not more than 5 per cent., judging from my own experience.

I firmly believe that the designing and construction of wireless receiving apparatus is the work of properly qualified electricians, using material bought through the usual trade houses.

That the public are generally properly fed up with the results obtained from amateur-made sets, and cheap improperly designed shop-bought sets, is evidenced to me every day. Yet, what with daily paper circuits and long-range crystal sets, to which latter an amplifier can be added to work a loud speaker (ye gods) the designer and constructor of a single valve regenerative receiver at, say, £5 complete, a 2-valve ditto at, say, £7, and a 3-valve at £9, which will drive a loud speaker almost to death, finds it an almost hopeless job to sell his goods, all and any of which can be heard and demonstrated.

What happens in most cases, is that an attempt is first of all made to construct a set according to the diagrams shown in last night's ——.

A purchase from the barber's and sweet shops mentioned by Mr. Perkins, or the cheap junk shop where you get things "very cheap," and the aerial is erected.

Results: "Sh-h, sh-h-, close that door, stop that noise there, father is trying to listen in." After many nights of this kind of thing you accidentally run into your acquaintance, who calls wireless all the names he can think of, and is so fed up with the whole thing that he will neither give you an order for a decent set nor take out a licence. His experience has cost him quite probably much more than I should have charged him.

Now this kind of thing is going on all over the place, and must be the same all over the country, and although I am not in a position to suggest anything, I do hope in the interests of the electrical business generally that something will be done to stop this cheapening of the electrical profession. One might as well expect to see daily diagrams of shop and house wiring, armature winding, or any other branch of the electrical profession, and sweet shops selling ceiling roses and lampholders. I see some of our huge emporiums are actually retailing electrical accessories, but as the electrician is usually required to do the work of wiring, &c., this branch of the trade is still electrical.

I feel sure that within a very short time a big reaction will take place—in fact it is taking place—and at no very distant date a person will be content to purchase a wireless receiving set from a *bona-fide* man (dealer or electrician) and have it properly installed, be instructed in its proper use, and be left a satisfied customer so far as we are concerned.

That is, we are not responsible for atmospherics, induction, hum on land lines, &c., &c.

H. Fowler.

Liverpool, *August 9th*, 1924.

Business Notes.

Bankruptcy Proceedings.—ALFRED WILLIAM MATTHEWS and FREDERICK GEORGE MATTHEWS, late trading as the Electrical, Gas and Engineering Co., 130, Main Road, Handsworth, Sheffield, electrical, gas, and engineering contractors.—The receiving order in this matter was made on July 24th on debtors' own petition. The statement of affairs shows liabilities of £177, against assets of £3, thus leaving a deficiency of £174. Debtors attribute their failure to insufficient business, heavy expenses, lack of capital, unemployment of two sons, and small profits. They traded on credit from the start, and during the period of trading there has been insufficient work to keep even one of them fully employed. The first meeting was held on August 13th. Public examination October 2nd, at the County Court Hall, Sheffield.

S. HOLMES, electrical engineer, 5, Gibson Street, Burmantofts, Leeds.—First meeting August 14th, at the Official Receiver's office, 24, Bond Street, Leeds. Public examination September 23rd, at the County Court House, Leeds.

W. E. MELROSE, electrical engineer, Chewton Road, Keynsham, Bristol.—Receiving order made August 6th on debtor's own petition.

F. S. BOWEN (Manchester Electrical Maintenance Co. and F. Bowen & Co.), electrical engineer, 7, Brazennose Street, and 43, Thomas Street, Manchester.—Receiving order made August 6th on creditor's petition.

J. BURKETT, electrical engineer, 185, John Clay Street, and 78, Anderson Street, South Shields.—First meeting August 20th, at the Official Receiver's office, Pearl Buildings, 4, Northumberland Street, Newcastle-on-Tyne. Public examination August 21st, at the Court House, Newcastle-on-Tyne.

W. N. BERRY, lately carrying on business in co-partnership with H. Bamber (W. N. Berry & Co.), electrical engineer, 32, Queen Street, Manchester.—Bankrupt discharged on June 30th, subject to consenting to judgment being entered against him for £5. (£5 paid to the Official Receiver.)

Company Liquidations.—COOPER & KING, LTD., electrical engineers and contractors, 17, Castle Street, Cardiff.—The creditors were called together recently at the offices of Messrs. Corfield & Cripwell. Mr. W. A. J. Osborne, who presided, submitted a statement of affairs disclosing liabilities of £2,745, all due to unsecured trade creditors. The bank was shown as a fully-secured creditor for £930. The assets were set down at £1,413, and were estimated to realise £963. The net assets were £911, or a deficiency of £1,834.

Mr. Osborne reported that the two directors in the company, Messrs. Cooper and King, were entitled to prove for substantial amounts in respect of arrears of salary and commission due to them. He had explained to them that the position, so far as the creditors were concerned, was unsatisfactory, and they had therefore agreed to withdraw any claims which they might have. Had Messrs. Cooper and King not withdrawn, the liabilities would have been increased by about £2,000. Messrs. Cooper and King were entitled to draw about £500 per annum each, but they appeared to have only received small weekly amounts. Towards the end of 1920 a branch business was opened at Swansea, where there was a heavy loss, and that venture was closed down after about a year. During the year ended March 31st, 1920, there was a loss on the trading of £653. For the next year (1921) there was a profit of £419; in 1922 a loss of £133 on a turnover of £15,098; in 1923 the turnover fell to £6,297, with a loss of £950; and for the 12 months to March, 1924, the sales were £7,130, with a loss of £231. During 1923 the total drawings of the two directors were only £240, and in 1924 they drew nothing at all. The deficiency in the statement of affairs was accounted for by the loss on the trading, together with the depreciation written off the assets. Messrs. Cooper and King were previously employed by a well-known electrical firm, but subsequently started in business at Cardiff in partnership, and formed the company in 1919. They put £500 into the business, and the total issued capital was now £1,000, shares having been subsequently issued to them in lieu of moneys to which they were entitled.

In answer to questions, Mr. Osborne stated that at the moment there were no big contracts in hand. The biggest was with the Office of Works, but he was of opinion that the overhead expenses had been too heavy, whilst the prices of some contracts had been cut too fine. There was no offer, and the suggestion was made that the assets should be realised, as it was impossible to continue the business.

A resolution was passed confirming the voluntary liquidation of the company, with Mr. Osborne as liquidator.

The following are creditors:—

	£		£
Crossley Bros., Ltd.	213	Liverpool Electric Cable Co., Ltd.	126
Chloride Electrical Storage Co., Ltd.	106	Metal Agencies, Ltd.	19
Crompton & Co., Ltd.	67	Metropolitan-Vickers Electrical Co., Ltd.	160
Electrical Conduits, Ltd. ...	229	Shaw (Glasgow), Ltd.	39
E.E.E. Carbon Co., Ltd. ...	54	Sanders, W., & Co.	30
General Electric Co., Ltd. ...	1,166	Tudor Accumulator Co., Ltd....	139
W. T. Henley's Telegraph Works Co., Ltd.	59	Forks, J., & Son	21
Jenkins & Howell...	45		

J. W. B. ACCUMULATORS, LTD. (formerly J. W. Barnard and Haynes, Ltd.).—Winding up voluntarily. Liquidator, Mr. F. W. Conning, 4, Great Winchester Street, E.C. A meeting of creditors was called for August 11th. Particulars of claims are to be sent to the liquidator forthwith.

SWARBEN, LTD.—Liquidator, Mr. H. E. Burgess, Senior Official Receiver and liquidator, Carey Street, W.C., released July 29th.

RADIO GRAMOPHONES, LTD., Bolsover Street, London, W.—Pursuant to Section 188 of the Companies (Consolidation) Act, 1908, a meeting of the creditors of the above was held on August 8th, at 10, Coleman Street, E.C., when the chair was occupied by Mr. Millar, who had been appointed to act as the liquidator in the voluntary liquidation of the company. He reported that the assets were more than sufficient to pay the creditors 20s. in the £, and the meeting broke up without any resolutions being passed.

Dissolutions of Partnership.—A. BEHM, wireless apparatus manufacturer, 15, Cromer Street, Gray's Inn Road, W.C.—Mr. A. Behm and Mr. I. Shapin have dissolved partnership. Mr. Behm will attend to debts.

MARLBOROUGH ENGINEERING CO., electrical and general engineers, Marlborough, Wilts.—Mr. E. G. Russell and Mr. A. J. Hawkings have dissolved partnership. Mr. Russell will attend to debts.

BEANCO ELECTRICAL MANUFACTURING CO., electro-medical and wireless apparatus manufacturers, 21, Bowling Green Lane, Clerkenwell, E.C.—Mr. W. H. Brown and Mr. W. Goodchild have dissolved partnership. Debts will be attended to by Mr. Brown, who will continue the business.

Trade Announcements.—The business of the ELECTRICAL ALLOY CO. has been transferred from Messrs. Williams, Pell and Baring to Messrs. Oliver Pell Control, Ltd., Granville House, Arundel Street, Strand, London, W.C.2, to whom all communications should be addressed. The department dealing with the Electrical Alloy Co.'s products will be managed by Mr. F. B. Pell (late partner of Williams, Pell & Baring), and the stock held in London is to be increased.

THE ENFIELD CABLE WORKS, LTD., has recently opened new offices and stores at 181, West George Street, Glasgow, with Mr. G. J. Andrews as manager and Mr. L. G. Toplis as assistant manager. Orders for v.i.r. wires and flexibles will be dealt with from stock.

MR. HAROLD MANDEFIELD, late partner in the firm of Mandefield & White, electrical engineers, of Clarence Street, York, has commenced business at 59, Gillygate, York. The business at 28, Clarence Street will be continued by Mr. Arthur Eric White on his own account.

Catalogues and Lists.—THE METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Descriptive leaflet No. 445/1-1, illustrating several installations of the company's steam turbine plant and auxiliaries.

MESSRS. F. & R. H. KIRKUP & CO., 153-155, Pilgrim Street, Newcastle-on-Tyne.—A pamphlet advertising "Wills" patent cable clips and hangers.

The British Electric Transformer Co., Ltd., Hayes, Middlesex.—A well-produced publication (Pamphlet No. Z. 750) illustrating many types of "Berry" transformers, and the company's works.

Messrs. Alfred Herbert, Ltd., Coventry.—A booklet entitled "Accurate Measurement and its Commercial Value," describing the firm's "Wickman" universal gauge-measuring machine.

Mr. O. N. Beck, 11, Queen Victoria Street, E.C.4.—An illustrated pamphlet containing a description of the "Universal" electrically-operated boiler-scaling apparatus.

Messrs. Sellar, Inglis & Co., 144, St. Vincent Street, Glasgow.—An illustrated folder containing a list of manufacturers of boiler plant, electrical machinery, and instruments, &c., for which the firm holds agencies.

The Carpax Co., Ltd., 312, Deansgate, Manchester.—A pamphlet illustrating and describing the "Kodel" portable radio receiver.

Messrs. Watson & Sons (Electro-Medical), Ltd., Sunic House, Parker Street, Kingsway.—An illustrated and priced catalogue of electro-medical apparatus; a list of radiographic instruments for the dentist; and a brochure dealing with the "Sunic" intensifier screen.

British Thomson-Houston Co., Ltd., Rugby.—Descriptive List No. 5,022 A and Price Supplement No. 5,022, containing information relating to d.c. drum controllers and resistances.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—August list of dynamos and motors in stock.

Albert & J. M. Anderson Manufacturing Co., 12, Moor Lane, E.C.2.—A leaflet illustrating and describing mine suspensions for electrical purposes.

M. Alfred Barth, 179, Rue Gaucheret, Brussels.—A list of electric lamps and a pamphlet describing a rotary switch, both priced in Belgian francs.

Book Notices.—"Personal Recollections of Some Notable Scientific Men," by Alan A. Campbell Swinton, F.R.S. (Reprinted from the *Journal* of the Royal Society of Arts.) Hastings: F. J. Parsons, Ltd.—In this "paper," which was read before the Royal Society of Arts in March, Mr. Campbell Swinton recounts a number of very human and humorous stories of some of the many eminent scientists and engineers with whom he has come into contact. Among the well-known figures of whom good anecdotes are told are Lord Kelvin, Huxley, Lord Armstrong, Sir Andrew Noble, Bell, Edison, David Hughes, Sir William Crookes, and many others.

"The Japanese Journal of Physics," Vol. II, Nos. 1-2, 3-5, and 6-10. Tokyo: The National Research Council of Japan.—In addition to the reproduction of papers at full length, these issues of the Journal contain a number of abstracts of Japanese papers on physical subjects.

Scientific Papers of the United States Bureau of Standards, No. 486, "Some New Thermoelectrical and Actinoelectrical Properties of Molybdenite"; and No. 487, "A Quantitative Study of Regeneration by Inductive Feed Back." Washington: Government Printing Office. Price 10 cents each.

Standard Electrical Catalogues.—At the last meeting of the Union des Syndicats de l'Electricité, in Paris, the special committee which has for some time been considering the many-years-old and oft-recurring question of standard size catalogues for the electrical trade, presented a report in which the view was expressed that not only was a standard size catalogue desirable, but that it was possible for the trade to adopt it. What optimism! After discussion a resolution was adopted by the Union to the effect that makers of electrical plant and apparatus should agree to adopt a standard size for their catalogues and also for the arrangement of the descriptive matter and illustrations. What monotony!

Market for Wireless Apparatus in Norway.—A confidential report on the market for wireless apparatus in Norway has been prepared by the Department of Overseas Trade from information received from the Commercial Secretary at Christiania (Mr. C. L. Paus).

Wage-Earner or Boss?—Those who make it their business to closely read our weekly reports of failures of electrical businesses will probably have little difficulty in understanding why we make the following quotation from the issue of *Electrical Merchandising* just to hand:—

"*What's Your Salary?* Three men were in conference with the credit manager for an electrical jobber. They had been in business as contractors for five months, and they were showing the credit man that in that time they had increased their net worth from the five hundred dollars they went into business with to $1,000, and they were now entitled to credit from his house. Putting his finger on the item 'salary—$1,000,' the jobber asked for details. He learned that the three men had drawn $200 a month among them, or $66.66 each. Folding up the statement, the jobber handed it back. 'Gentlemen,' he said, 'you are not entitled to credit. You think you have made $500. You have not. You have lost about $1,700 in your five months of business life. You are three good wiremen and are worth $175 a month each. You could get that from a half-dozen or more contractors in this city. And if your business cannot pay you what another contractor would, why should you bluff yourselves that you are making money by paying yourselves one-third of what you are worth? Your wives deserve a great deal of credit, not yourselves.' Just because this is an extreme case, it is a good illustration of the fact that many men are showing a profit at the expense of their salary."

Copper and Lead Prices.—Messrs. F. Smith & Co. report August 12th:—Copper (electrolytic) bars, £68 10s., 20s. increase; do. do. sheets, no change; do. do. wire rods, £78 10s., 20s. increase; do. do. h.c. wire, 9 13-16d., 1-16d. increase.

Messrs. James & Shakespeare report August 13th:—Copper bars (best selected), sheet and rod, no change; English pig lead, £33 15s., 5s. decrease.

Australian Electrical Imports.—In the Electrical Review for January 11th, 1924, p. 56, we gave an abstract of the imports of electrical machinery and appliances into Australia during the year 1922-23. The *Australian Electrical Times* for June quotes the following figures, which show the share of the United Kingdom, the United States, and some other countries respectively in this trade. The statistics are taken from the Bulletin of Overseas Trade (No. 20) published by Mr. C. H. Wickens, F.I.A., F.S.S., Hon. M. S.S. (Paris), &c., Commonwealth Statistician, and the figures are for 1922-3, except in a few cases in which 1921-22 returns are the latest available:—

Secondary batteries, United Kingdom, £57,713; U.S.A., £26,992; cotton covered wires and cables, United Kingdom £15,094; paper-insulated, lead-covered telegraph and telephone cables, U.K., £239,343. Other covered wires and cables, U.K., £933,927; U.S.A., £12,782.

Carbon manufactures, including carbon blocks, U.K., £10,918; U.S.A., £4,228.

Dynamo-electric machines, U.K., £645,367; Sweden, £35,148; U.S.A., £241,168.

Electric fans, U.K., £15,884; U.S.A., £16,746.

Switches, fuses, lightning arresters, U.K., £121,283; U.S.A., £86,712.

Heating and cooking appliances, U.K., £9,132; U.S.A., £8,406.

Metal-filament lamps, U.K., £172,642; Netherlands, £123,184; U.S.A., £36,398.

Measuring and recording instruments, U.K., £119,050; Canada, £3,674; Switzerland, £29,410; U.S.A., £22,781.

Regulating, starting and controlling apparatus, U.K., £242,619; Canada, £3,498; U.S.A., £281,053.

Static transformers and induction coils, U.K., £63,722; U.S.A., £79,875.

Telegraph instruments, U.K., £3,054; U.S.A., £1,261.

Telephones, U.K., £114,024; Canada, £19,077; U.S.A., £59,415; Sweden, £2,065.

Telephone switchboards, U.K., £97,260; Belgium, £5,522; Sweden, £2,748; U.S.A., £154,506.

Vacuum tubes, U.K., £5,169; Netherlands, £306; U.S.A., £2,278.

Electrical appliances not specified above, U.K., £354,191; Netherlands, £98,396; U.S.A., £223,115.

Electrical insulating paper and boards, U.K., £2,619; U.S.A., £1,295.

Electrical earthenware, including insulators, U.K., £2,064; Canada, £1,397; Japan, £1,018; U.S.A., £8,226.

A Quality Mark for French Goods.—A proposal was brought forward at the last meeting of the Union des Syndicats de l'Electricite in Paris by the Syndicat de l'Appareillage Electrique that a quality mark should be established so that the public would be provided with goods which they would know were in accordance with the technical standards of the Union. It was suggested that the use of the mark should be accorded to manufacturing firms by a special jury to be appointed.

French Electrical Imports and Exports.—Returns lately issued show that the imports of electrical machinery and apparatus into France during the first three months of the current year attained a value of 55,753,000 fr., as compared with only 29,755,000 fr. in the corresponding period of 1923. There has, however, been a greater increase in the exportation of such material of French manufacture—from 62,930,000 fr. in the first three months of 1923 to 94,452,000 fr. in the first quarter of 1924.

Local Exhibitions.—The Shropshire, Worcestershire and Staffordshire Electric Power Co. is arranging a series of "Electricity in Service" exhibitions in towns in its area of supply. The first will be held at Kidderminster from August 19th to 22nd, and this will be followed by others at Dudley from September 2nd to 5th, Smethwick from September 16th to 19th, Redditch from September 30th to October 3rd, Bromsgrove from October 14th to 17th, and Halesowen from October 28th to 31st. All manner of appliances for use in the home will be shown and demonstrated.

E.D.A. Activities.—The latest batch of "Electricity in Service" publicity matter issued by the British Electrical Development Association is composed of a set of thirteen leaflets, each containing a short talk on various aspects of the subject. These are written in an easily digestible manner, and seem admirably adapted to their purpose of interesting the layman in electrical development. Some of them are distinctly original, as, for instance, the one dealing with "An Electric Alcoholic Cure."

The Association has also published a new edition of its pamphlet No. 486, "Electricity on the Farm," which contains an account of actual experience gained by Mr. Borlase Matthews.

Radio Valve Service.—In a booklet issued by the British Radio Valve Service, Ltd., the company's objects are fully set out. From this it appears that the aim is to provide a purchasing, testing, and information service for users of thermionic valves. Particulars are given of a competition for valve users.

Radio Sales in South Africa.—*The British and South African Export Gazette* states that in recent months there has been a big advance in the sales of radio apparatus. "One Johannesburg firm alone has stated that it has £70,000 worth of wireless apparatus on indent, and is loaded with orders from all parts of the country. In fact, there is a rush for these goods compared with which the previous healthily expanding business was a mere flea-bite. Last year's imports, for example, were valued at £29,224, or less than half a single firm's unexecuted indents at the present moment. As will be readily understood, the trade is almost entirely British, America being the only serious competitor in 1923, with shipments to the small value of £2,570. It needs no prophetic skill to enable it to be said with confidence that during the next few months the demand will be far greater than the supply."

Norwegian Appliance Duty Reduced.—*Reuter* reports that the Norwegian Storting has adopted a resolution decreasing the duty on certain electrical appliances.

Chinese Notes.—The Sheng Po Storage Battery Manufacturing Co. has recently commenced the business implied by its title in Shanghai.

If the automatic telephones recently installed in the East Exchange, Shanghai, prove satisfactory, the city will be completely equipped with the automatic system in two or three years. The number of direct lines now in use in the International and French concessions of Shanghai is 15,963. This is the largest system in China. Tenders have been invited for the conversion of the central exchange to the automatic system.

The Ministry of Communications is preparing to participate in the International Telegraph and Telephone Administration Conference this autumn, and has organised a special commission to study the questions which will be considered at the Conference.

Russian Note.—TRANSPORT IN THE BAKU OIL REGION.—The Central Electrical Trust has received an order for the supply of the electrical equipment for an electric railway between Baku and Soorakan, a distance of over 20 miles. This will be the first line in Russia to be specially constructed for serving the workmen engaged in the Baku oil industry. The carriages will be, it is said, of the Pullman type, and will be equipped with four motors instead of two, capable of producing a speed of up to 40 miles per hour. Work on the contract has already been commenced, and the line is to be completed in 14 months, together with the five sub-stations for supplying the current.

American Concentration on the British Market.—*Electrical Merchandising* states that in order to enable the American manufacturer to advertise his goods properly to the British consumer, Mr. F. M. Feiker, formerly editor of that paper and vice-president of the McGraw-Hill Co., Inc., and now connected with the Society for Electrical Development, has been designated by Secretary of Commerce Hoover to make an intensive study of British advertising methods. Mr. Feiker sailed from New York on July 2nd, his intention being to visit the industrial centres of England to collect material which will enable the American advertiser to successfully present his wares through the printed word to the British consumer in competition with the merchants of other countries. In announcing Mr. Feiker's mission, the Department of Commerce stated:—"Great Britain is America's most important export market. Recently there has been a flood of inquiries for more up-to-date information on the subject of effective advertising, and Mr. Feiker, because of his long experience in this line of work, has been selected by the Department as an ideal man to gather the information needed to put 'Made in U.S.A.' over the top in the British Isles."

British Trade-mark Applications.—The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from the dates mentioned. In the case of foreign applications, the name and address of the British representatives are also given:—

Kaynite. No. 446,860.—All goods in Class 8. A. W. Knight, Ltd., 167, Rye Lane, Peckham, London, S.E.15. July 30th, 1924.

Sudia. No. 448,330. Class 8.—Electrical time switches and temperature regulators. Louis Paul Haussauer, trading as Louis Haussauer, 30, Ely Place, London, E.C.1. July 30th, 1924.

Abgar (lettering and design). No. 449,191. Class 8.—Apparatus for use in wireless telegraphy and telephony. Charles Scrafton Holthouse, Abbey Garage, 39-40, St. Andrew Street, Plymouth. July 30th, 1924.

Capitol. No. 449,806. Class 8.—Instruments and apparatus for use in wireless telegraphy and telephony. Hobday Bros., Ltd., 21-27, Great Eastern Street, London, E.2. July 30th, 1924.

A.C. (lettering and design). No. 444,501. Class 13.—Sparking plugs. The A.C. Spark Plug Co., Flint, Mich., U.S.A. (White, Langner, Stevens & Parry, Jessel Chambers, 88-90, Chancery Lane, London, W.C.2.) July 30th, 1924.

Ivanhoe Regent. No. 449,091. Class 15.—Glass. The British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C.2. July 30th, 1924.

Trojan. No. 449,092. Keldon. No. 449,093. Ivanhoe Ace. No. 449,090. Class 15.—Glass. The British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C.2. July 30th, 1924.

Stecolite. No. 448,713. Class 50.—Moulding material and electrical insulating material in the nature of phenol-formaldehyde condensation products. Sterling Telephone and Electric Co., Ltd., 210-212, Tottenham Court Road, London, W.1. July 30th, 1924.

Shellac. No. 448,984. Class 4.—Turner, Atherton & Co., Ltd., Denton, Manchester. August 6th, 1924.

Maxtorq. No. 448,244. Class 6. Dynamo-electric machines and parts of such machines.—The Lancashire Dynamo and Motor Co., Ltd., Trafford Park, Manchester. August 6th, 1924.

VacTric. No. 449,267. Class 6. Vacuum cleaners, electric motors, fans, and blowers.—Vac-Tric, Ltd., 12-13, Henrietta Street, London, W.C.2. August 6th, 1924.

Abelesco. No. 448,791. Class 8. Electric signalling apparatus for mines and quarries, wireless telephonic receiving sets and sound amplifiers, electric cables and flexibles, and electrical distribution boards.—W. E. Collins, trading as the Albion Electric Stores, 9, New Station Street, Leeds. August 6th, 1924.

Zaza. No. 449,104. Class 8. Electric batteries (not for medical purposes).—The Metropolitan Lighting Co., Ltd., 25, Atlantic Road, Brixton, London, S.W.9. August 6th, 1924.

Nelson Multi (lettering and design). No. 449,011. Class 8. Wireless valves, wireless receiving sets, loud speakers, and accessories therefor.—Frank Warner, 138, Kingston Road, Merton Park, London, S.W.19. August 6th, 1924.

Spirella. No. 449,286. Class 8. Electric coils.—G. Gilliver and Co., Ltd., 6, Panyer Alley, Paternoster Row, London, E.C.4. August 6th, 1924.

Dousona. No. 449,416. All goods in Class 8.—T. Grimes and Co., Ltd., 32, Duppass Hill Lane, Croydon. August 6th, 1924.

Rubellit. No. 448,171. All goods in Class 40.—Accumulatoren Fabrik Gesellschaft, 3, Askanischer Platz, Berlin, S.W.11 (Edward Evans & Co., 27, Chancery Lane, London, W.C.2). August 6th, 1924.

An All-Irish Tramcar.—At the Horse Show grounds in Dublin last week the Dublin United Tramways Co. had on view an electric tramcar ready for use, designed and constructed entirely in Dublin by the company's own staff. The design was by Mr. G. Marshall Harriss, the company's general manager, who has succeeded in planning a top-covered tramcar which will pass under low bridges. The car was built entirely at the company's works at Inchicore, Dublin, where also the electrical equipment and special fittings were assembled. The brass castings were made at the company's works at Ballsbridge, Dublin. The timber used in the construction of the car, with the exception of the mahogany and maple of the panels, is chestnut, oak, and larch, grown in the Powerscourt demesne, County Wicklow.

L.M. & S. Railway Orders.—During the period February-June of the current year the London, Midland and Scottish Railway Co. has placed orders for plant and machinery of all kinds with British firms to the total value of £120,089. Among these orders the following may be mentioned as being of electrical interest:—British Thomson-Houston Co., Ltd., motors and transformers; Metropolitan-Vickers Electrical Co., Ltd., transformers and truck-type cubicle switchgear; Electric Construction Co., Ltd., motors; Cowans, Sheldon & Co., Ltd., a 22-ft. electric traverser; Lancashire Dynamo & Motor Co., Ltd., a size 16 magnet and brushgear; Ferguson, Pailin, Ltd., a four-panel cubicle switchboard; General Electric Co., Ltd., three control panels; Herbert Morris, Ltd., a 2-ton electric hoist block; British Vacuum Cleaner & Engineering Co., Ltd., suction plant for Derby power house; and Electromotors, Ltd., and J. P. Hall & Co., Ltd., wheel-lathe motors.

Electricity Supply Workers' Wages.—As mentioned in our last issue, a meeting of the unions concerned in the demand for a general increase in wages of 10s. per week is being held to-day (Friday). It has been stated, unofficially, that an offer of a 10 per cent. increase has been made by the employers; this will probably form a basis of negotiations.

Railway Shopmen's Wages.—The railway companies have refused the demand of men employed in the railway workshops for an increase of from 10s. to 12s. per week, consolidation of the "war" addition of 16s. 6d. per week, and other improved conditions. The companies state that the standard time rate paid conforms very closely to the rate paid in outside engineering works, and, in addition, the men in the railway shops are in receipt of 6s. 6d. per week more "war" wage than those outside. A meeting of the unions concerned will be held next week to consider the matter.

United States Electrical Exports.—*Commerce Reports* states that United States exports of electrical goods during May totalled $7,206,587, according to preliminary figures, as compared with $5,349,568, for the same month of 1923, this gain being quite broadly distributed over the whole range of electrical classes. Apparatus lines, especially transformers, showed a general gain; in the case of the items named, the number of units did not increase greatly, but the average capacity and value per transformer were considerably above those for 1923. The stationary motor class is practically the only apparatus class in which there was any marked decrease, the biggest drop being in motors under 1 h.p. Railway motors showed a good increase, but electric locomotives decreased. In general appliance lines, motor-driven household devices remained practically unchanged, but there was a consistent gain in the case of domestic heating and cooking devices, while fan shipments were more than double those of May, 1923. Radio exports continued to increase, and to that influence was possibly due some of the good increases shown in the shipments of batteries, both primary and secondary. Wiring devices and miscellaneous supply lines all showed a fair increase, and insulated wire and cable exports were approximately 13 per cent. above the figure for the same month of 1923.

British Empire Exhibition Notes.—Correction.—In our last issue we stated in the description of the Cotton Textile Industry Exhibit in the Palace of Industry that the intermediate ring doubling frames were driven by "Lancashire" squirrel-cage motors through "Broadbent" clutches. The Lancashire Dynamo & Motor Co., Ltd., informs us that this is not the case; the clutches in use are of the company's own manufacture—"Lancashire" automatic centrifugal clutch couplings.

British Industries Fair Catalogue.—The Department of Overseas Trade notifies us that a limited number of copies of the catalogue of the London Section of this year's British Industries Fair can be obtained from the offices of the Department. This catalogue forms a convenient buyers' guide, and should be of service to traders who desire to purchase British goods.

New Italian Companies.—There have been formed at Milan the Società Idroelettrica del Bardellino with a capital of 20,000,000 lire in 100-lire shares, and the Società Idroelettrica de l'Allione with a capital of 10,000,000 lire.

Lighting and Power Notes.

Blackpool.—Allocation of Profit.—The profit on the electricity undertaking for the past year has been distributed as follows:—Rate relief, £10,000; reserve fund, £10,000; working balance, £15,000; carried forward, £6,502.

Brighton.—Year's Working.—The report upon the municipal electricity undertaking (engineer: Mr. J. Christie) for the year ended March 31st last records a total income of £185,017 and a working expenditure of £130,551, as compared with £188,161 and £122,016 respectively in the previous year. The gross profit was thus £54,466, as against £66,144. After defraying the capital charges and contributing £3,120 to capital outlay, there was a net profit of £13,492, making a total available, with the surplus brought forward from the previous year, of £41,390. This was distributed as follows:—Rate relief, £15,000; reserve, £12,898; balance carried forward, £13,492. The sales of energy increased by 2,337,201 kWh to 15,666,907, and the average price per kWh obtained fell from 2.65d. to 2.43d. The maximum supply demanded rose from 8,700 to 10,200 kW. A new 400-kW house service generator, one 6,000-kW turbo-alternator, and two new Yarrow boilers are being installed, and will be formally inaugurated on September 10th next. The engineer has recommended that the charges for electricity for street lighting be reduced from 2½d. to 2d. per kWh, and for tramway supplies from 1.5d. to 1.3d. per kWh.

Bristol.—Year's Working.—The accounts of the city electricity undertaking (engineer: Mr. H. Faraday Proctor) for the year ended March 31st last record a total revenue of £370,906, as compared with £337,254 in 1922-23. Working expenses totalled £216,886, as against £202,454, leaving a gross profit of £154,920 (£134,800). After deducting capital charges, there was a net surplus of £67,809, as compared with a profit of £58,316 in the previous year. A contribution of £16,000 has been made to the borough fund, and a further sum of £16,000 is reserved for that purpose for the year 1924-25. The capital expenditure during the year, which included £46,592 for machinery and £79,294 for mains, amounted to £153,819. The sales of energy increased from 43,116,425 to 50,125,480 kWh, and the price per kWh obtained fell from 1.76d. to 1.67d. A scheme for the future equipment of the whole of the city area has been prepared, providing for an immediate increase in the capacity to about four times that which at present exists, with provision for further expansion when necessary. It is proposed to change over the system of supply outside the borough from single- to 3-phase. New mains, with a total length of 40 miles, have been laid during the year and several sub-stations have been constructed.

Croydon.—Year's Working.—The report of the borough electrical engineer (Mr. A. C. Cramb) upon the working of the electricity undertaking during the year ended March 31st last shows a total income of £173,150, as compared with £177,730 in the previous year. The expenditure charged to revenue account amounted to £124,841, as against £102,213, leaving a gross profit of £48,309 (£75,517). After charging capital services against this amount, a net surplus of £2,446 remained, as compared with £36,371 in 1922-23; this was transferred to reserve. The capital expenditure during the year amounted to £54,261, the chief item being £45,869 for mains. The sales of energy rose from 12,592,515 to 14,947,610 kWh, there being an increase in the supply for power purposes and the "all-in" rate. The average price per kWh obtained fell from 3.33d. to 2.72d., and the maximum supply demanded rose from 7,100 to 8,600 kW. The length of cables laid during the year increased by 70 miles to a total of 400 miles. A second Clayton & Shuttleworth boiler is being installed and will be completed in time for next winter's load. To meet the increasing load, an order has been placed for a fourth turbine of 10,000 kW.

Edinburgh.—At a recent Town Council meeting, the Corporation Electricity Committee submitted a report by Mr. H. J. Deane, M.Inst.C.E., on the foundations of the Portobello power station. It pointed out that the raft under the turbine house was designed for sets of 10,000-kW capacity. Three such sets have been installed, and there is every reason to be satisfied that the design of the foundations which carry these loads is adequate, and that therefore the space in this house left vacant for additional plant may safely be utilised for this purpose. Mr. Deane is of opinion that a similar set of 10,000-kW capacity can be safely installed, provided that proper precautions are taken to spread the resulting loads over as large an area as possible. The report was adopted.

Felixstowe.—Electricity in Bulk.—The Lighting Committee has submitted a report to the Urban District Council on the proposal to obtain an additional electricity supply for the district. It is recommended that a bulk supply be obtained from Ipswich Corporation at a cost of 1.352d. per kWh. A 22,000-V cable would be laid between the two towns, but at first only a pressure of 6,600 V would be used. The total capital expenditure on the scheme would be about £26,000.

Finchley.—Loan.—The Urban District Council is applying to the Electricity Commissioners for sanction to the borrowing of £17,000 for electricity purposes.

Gloucester.—Loan.—The City Council is applying to the Electricity Commissioners for sanction to a loan of £8,299 for cables.

Haslingden.—Year's Working.—The report on the working of the borough electricity undertaking (engineer: Mr. B. Kay) for the year ended March 31st last records a total income of £15,136, as compared with £15,758 in the previous year. Working expenses totalled £10,836 (£11,062), leaving a gross surplus of £4,300 (£4,696), to which was added contributions from adjacent authorities amounting to £200, and bank interest of £72, making a total of £4,573. After deducting capital charges, there was a net surplus of £1,215, as compared with a profit of £1,680 in 1922-23. The sales of electrical energy amounted to 1,807,737 kWh, an increase of 361,985 kWh, and the maximum supply demanded rose from 765 to 786 kW.

Electricity in New Houses.—The Housing and Town Planning Committee has decided to install electric light and "Kaybee" electric wash boilers in all the houses to be erected on the Rising Bridge estate.

Hastings.—Loans Sanctioned.—The Town Council has received the sanction of the Electricity Commissioners to loans of £1,691 and £1,578 for h.p. and l.p. mains, and £46,150 for plant, &c., for the new generating station at Broomgrove.

Haworth.—Electricity Supply.—The Urban District Council has decided to exercise the powers granted under an Electricity Order which was obtained in 1914. Instructions have been given to the consulting engineer to the Council to prepare the necessary details and obtain tenders for the carrying out of the work. Application is being made to the Electricity Commissioners for sanction to the borrowing of £7,500 for the purpose.

Irish Free State.—Killester (Co. Dublin).—It is proposed to introduce electric lighting in the new colony established for British ex-Service men. The matter is being considered by the Free State Minister for Local Government and Public Health.

Linlithgow.—Electricity Supply.—Following upon negotiations with the Scottish Midlands Electricity Supply Co., the Lighting and Electricity Committee of the Town Council has decided to introduce electric light in the town. A contract for converting street lamps from gas to electricity has been provisionally arranged, and a commencement has been made with the laying of the cables.

Malvern.—Loan Sanctioned.—The Urban District Council has received from the Electricity Commissioners sanction to a loan of £5,000 for extensions of mains and services.

(Continued on page 257).

High-Voltage Power Supply in Spain.

Some Notes on the Riegos y Fuerza del Ebro Undertaking.

HOWEVER backward she may be regarded in some directions, from an electrical point of view Spain has for many years past held an important position as regards the utilisation of water power. Especially is this the case in the northern part of the country, which is amply supplied with rivers fed by the snow from the Pyrenees. Among the important undertakings is that of the Sociedad Riegos y Fuerza del Ebro, of Barcelona, which is supplying electricity to an area of about 6,200 square miles in Catalonia, extending from Barcelona about 100 miles to the south along the Mediterranean coast and about 90 miles inland. Not only are the larger towns supplied but even the villages—not excluding those situated high up in the mountains—are provided with electric light and power for the operation of grape presses and farming implements, they being fed by overhead lines. Barcelona, where underground mains are employed, is, however, the principal consuming area, being responsible for about 65 per cent. of the total.

The principal power station of the group is that at Seros, 98 miles from Barcelona. It utilises the water power of the river by means of a dam no less than 1,279 ft. in length and 19.6 ft. high from foundation to crest. The water is diverted from the reservoir thus formed by means of a series of Stoney gates into a canal, having a discharge capacity of 13,200 gallons per second. The generating plant comprises four Escher-Wyss Francis-type vertical turbines of 14,000 h.p., each coupled to a G.E.C. (U.S.A.) 12,500-kVA generator, and two 500-h.p. turbo-exciters of similar construction. The water for the turbines is supplied under a static head of 177 ft. from four penstocks each 328 ft. long and 9.8 ft. in diameter. The pressure is stepped up to 110,000 volts by four transformer banks, each comprising three Westinghouse single-phase 4,444-kVA transformers, the total capacity being 53,328 kVA; the transformers are controlled by four automatic and four non-automatic oil switches. There are four 110,000-volt outgoing circuits at the station, protected by G.E.C. outdoor-type electrolytic lightning arresters. The four mains are supported in pairs on two separate sets of masts, the conductors comprising six wires, of either 107 or 127 square mm. copper section. The station is connected both with Barcelona and also with the Camarasa plant, the latter being 39 miles away.

Fig. 2.—The Seros Power House, Penstocks, and Living Quarters.

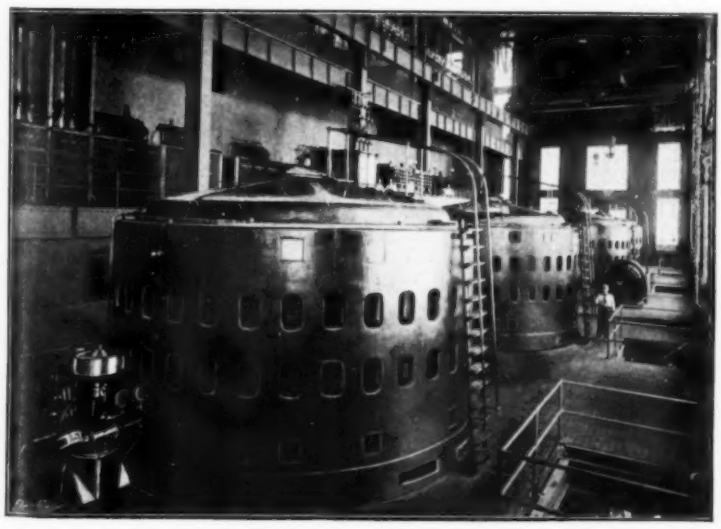

Fig. 1.—The Seros Generator Room.

The Tremp plant, which is the most distant from Barcelona (101 miles direct or 156¼ miles *via* Seros) of the 110,000-volt transmission stations, utilises the water of the River Pallaresa by means of a dam 269 ft. high and 675½ ft. in length, the resulting reservoir having a length of 5⅝ miles and an area of 92,193,000 sq. ft.; the full and useful capacities are respectively 48,421,000,000 and 43,359,000,000 gallons. The spillway gates provided are 32.8 ft. wide, and have a discharge capacity of 440,000 gallons per second; they are seven in number and of the automatic type, being operated by the water pressure on the gates, and by means of counterweights, have a definite period for operation. It is interesting to note that the water of the River Pallaresa is utilised three times before it passes to the sea, *viz.*, at the Tremp, Camarasa, and Seros stations.

Two penstocks 1,476 ft. in length and 9.18 ft. in diameter, working under a head varying from 104 to 223 ft., supply the power station, the plant at which comprises four twin horizontal turbines of a total capacity of 50,000 h.p., each set being coupled directly to a centrally-located 8,750-kVA, 6,600-volt generator running at 500 r.p.m. The transformer plant which steps up the pressure to 110,000 volts consists of three sets of three single-phase, 4,166-kVA units. The transmission lines comprise two 110,000-volt, three-phase circuits strung on one row of towers, electrolytic outdoor type lightning arresters being provided.

The Camarasa station, which is located at the confluence of the rivers Segre and Pallaresa, is supplied with water by means of a dam no less than 301⅞ ft. high, with a crest length of 459 ft., the full capacity of the reservoir, which has a length of nearly 14 miles, being

35,655,600,000 gallons. At the time of its completion it was claimed to be the highest dam in Europe. The water from the reservoir is conveyed to the station by a canal 826 ft. in length, 695 ft. of which is in tunnel; the canal capacity is sufficient for a flow of approximately 24,210 gallons per second. The spillway canal is located on the opposite gradient to the conveying canal; the discharge therefrom is effected by two automatic sluice gates of Swiss construction, each being capable of discharging 220,000 gallons per second.

The present generating plant comprises two 20,000-h.p. Escher-Wyss vertical-shaft turbines coupled to G.E.C. (U.S.A.) three-phase 50-cycle alternators, generating a total of 30,000 kVA at 375 r.p.m. The turbines are supplied with water by means of two penstocks 299 ft. long and 8½ ft. in diameter, the static and working heads being respectively 265½ and 261 ft. As the station is at present working at maximum capacity, plans are in hand for installing a further three sets of 20,000-h.p. turbo-generators. At this station there are no fewer than six incoming three-phase, 110,000-volt transmission lines supported on three separate masts, *i.e.*, two per mast, each circuit comprising six wires of 107 square mm. copper section. The outdoor lightning arresters are of the G.E.C. electrolytic type.

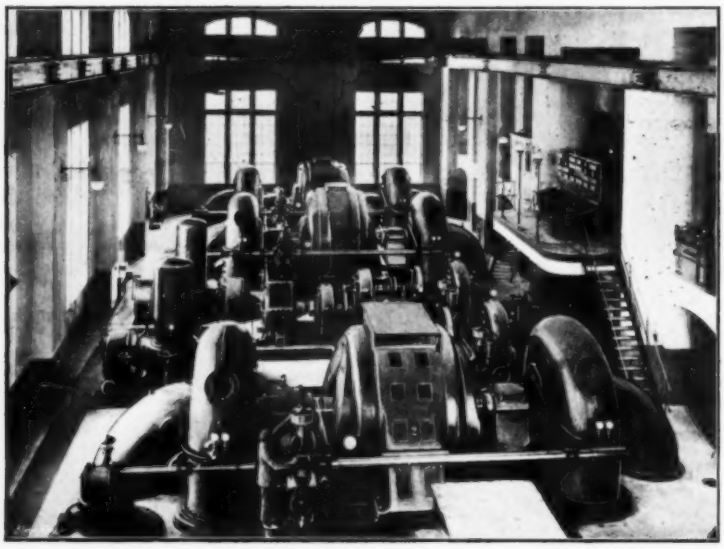

Fig. 3.—The Tremp Power House.

The Pobla station, which is the most distant from Barcelona, is employed to supply the immediate district. It utilises the water of the river Noguera-Pallaresa, which is diverted into a canal 3.3 miles long by means of a dam 285 ft. long at the crest and 13.1 ft. high. The canal has a depth of 8½ ft., and is able to deliver 36,315 gallons of water per second, it being conveyed to the power house by means of three 6.9 ft. diameter penstocks 128 ft. in length; the static head is 75 ft., and the working head 69 ft. The generating plant comprises three 1,500-h.p. Escher-Wyss horizontal turbines coupled to Westinghouse three-phase alternators running at 250 r.p.m., which generate a total of 3,750 kVA at 6,600 volts; the station working load is, however, only 2,000 kW. The pressure is stepped up to 25,000 volts by means of three Westinghouse three-phase transformers. In order to reduce the cost of installation, the transformers, air-break switches, and lightning arresters at all the stations are mounted in the open air on a simple framework.

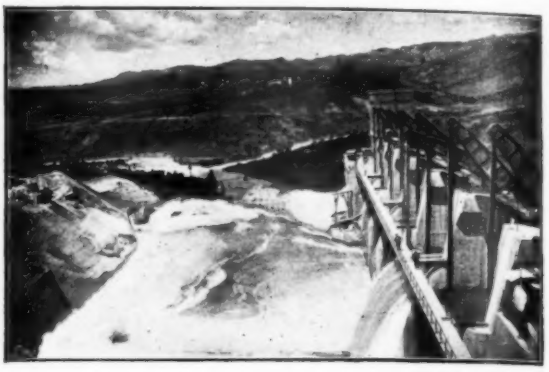

Fig. 4.—The Tremp Automatic Spillway Gates.

By way of reserve, a steam-operated plant is maintained in Barcelona; it comprises a battery of twenty boilers with a total heating surface of 94,120 sq. ft., and a superheating area of 30,830 sq. ft. The condensers are of the surface type cooled by sea water conveyed to the plant by an aqueduct 1,804 ft. in length. The main generating plant, which works at a steam pressure of 200 lb. per sq. in., comprises three 5,000-kW and one 12,000-kW Curtis turbines coupled to A.E.G. 6,600-volt, 50-cycle alternators running at 1,500 r.p.m. There are also installed two G.E.C. rotary synchronous condensers of 5,000 kVA each; one 450-kW and a couple of 1,000-kW motor generator sets working at 6,000 volts three-phase and producing 220 volt d.c. power; a 1,000-amp. d.c. voltage-regulating set and a Gould 140-cell storage battery with a discharge capacity of 8,250 Ah in three hours. Excluding the reserve

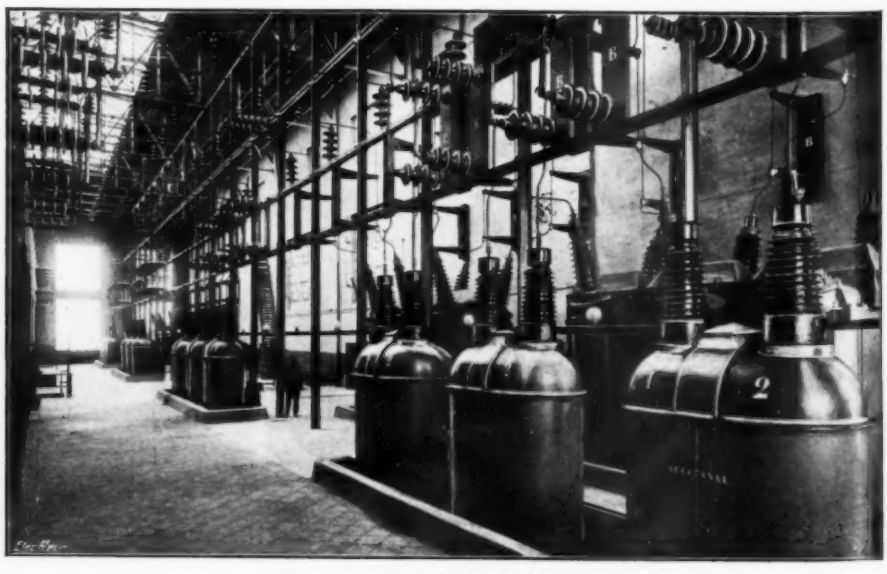

Fig. 5.—The Seros 110,000-V Oil Switches.

steam station at Barcelona, the total capacity of the Ebro Company's plant is about 120,000 kVA.

All the stations with the exception of that at Pobla transmit the 50-cycle, three-phase energy at 110,000 volts to the primary sub-stations located at Reus, Igualda, and Barcelona—there are two in the last named city—where it is reduced as required by local conditions, there being altogether over 500 miles of 25,000-volt mains and about 125 miles at 6,000 volts. The 110,000-volt network practically forms a triangle, with the Camarasa and Seros stations at the base, and Barcelona at the apex; each side of the triangle comprises two double three-phase circuits carried on lattice steel masts. All circuits are brought parallel at the apex of the triangle; the line consisting of about 250 miles of high-voltage mains thus forms a double collecting system.

The 110,000-volt lines are inspected daily, staff camps being located every 20 or 25 miles, they being in telephonic communication

Fig. 7.—The Camarasa Dam and Power House.

Fig. 6.—The Camarasa Generators.

with each other and the sector centres. Risks of interruption in the supply are avoided by (1) employing a high coefficient of mechanical and electrical safety; and (2) by so arranging the mains that the important centres of consumption are supplied by four circuits carried on two lines of masts which follow separate routes and are entirely distinct between the power plant and the terminal sub-stations. In this way any local storm which may temporarily put one set of two lines out of operation has no effect on the other. Any section momentarily damaged is automatically put out of service by means of high-pressure oil circuit-breakers.

No special difficulty is experienced with the parallel working of the main transmission line under normal conditions. At the various stations the oil-pressure automatic regulators are arranged to act simultaneously and not one after the other; there is thus no oscillatory action. The load is generally under the control of a load despatcher in order to ensure economical use of water. Generally speaking, the various plant behaves well when line troubles are experienced; in fact, it is claimed that in 95 per cent. of the cases all the stations remain in synchronism after the automatic interrupters have cut out the defective section.

The division of the load between the various stations is controlled at the central office by the chief engineer, whose decisions are based on the load curves, the water supply in the various rivers, the storage in the reservoirs, &c. At all the four stations, Tirrill regulators are provided.

For the rapid and exact localisation of deteriorated insulators, or group of insulators, without interrupting the normal work of the line, a special device is used. It was invented a few years ago by Mr. C. E. Bennett, then second chief electrical engineer of the company, in conjunction with Mr. F. Dejong, the chief of the Ebro laboratories. The instrument, which is stated to have proved to be very successful and to possess many advantages over the usual "buzz stick," is known as an "aislometer," and is designed to test chains of insulators while the line is working, utilising the transmitted current for the tests.

For the photographs used in this article we are indebted to Mr. C. E. Bennett; and many of the particulars here given were obtained from a paper by Mr. A. C. Hobble, engineer-in-chief of the company, at the first International Conference on Extra-High-Pressure Transmission Lines, published by the Union des Syndicats de l'Electricité at Paris.

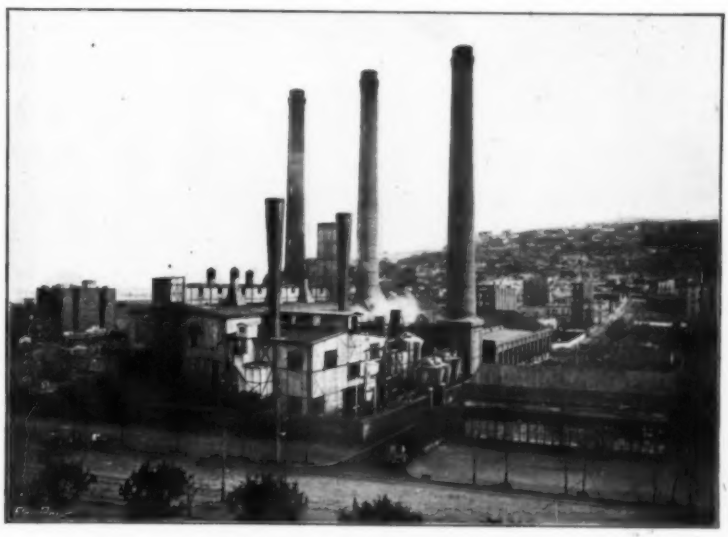

Fig. 8.—The Barcelona Auxiliary Steam Plant.

Some of the Exhibits at Wembley.

The Metropolitan-Vickers Traction Exhibits.

In addition to the extensive display of electrical apparatus at the British Empire Exhibition that has already been described,* the Metropolitan-Vickers Electrical Co., Ltd., exhibits a good deal of traction equipment, the wide range of motors and control gear including a railway motor of 250 h.p. at 1,500 volts d.c., and a tramway motor, complete with roller bearings, gearwheel and pinion. Contactors for control systems on railways, both of the electro-magnetic and electro-pneumatic types are shown, such as have been built chiefly for the South African railways and North-Eastern Railway, and are for voltages of 3,000 or 1,500 volts. A 305-h.p., d.c. traction motor for 1,500 volts, but insulated for 3,000 volts, also forms part of the exhibit, and amongst the smaller material of interest is a tramcar controller of the cam-operated type, as well as a miscellaneous set of railway and tramway control gear, pinions, coils, brush gear, &c. A railway train, complete with an electric locomotive, can be inspected in the South African Pavilion, fig. 183. The locomotive can be described as the most powerful so far built for a 3 ft. 6 in. gauge, and is one of 78 being built by the firm for the Glencoe-Pietermaritzburg section of the S. A. railways. They will use d.c. at 3,000 volts, and are arranged for regenerative braking. Three locomotives are normally coupled together and controlled from one driver's compartment. This arrangement is necessary for handling heavy trains on the steep gradients and sharp curves which occur on this section of the line.

Fig. 183.—Metropolitan-Vickers 1,200-h.p. Electric Locomotive for South Africa.

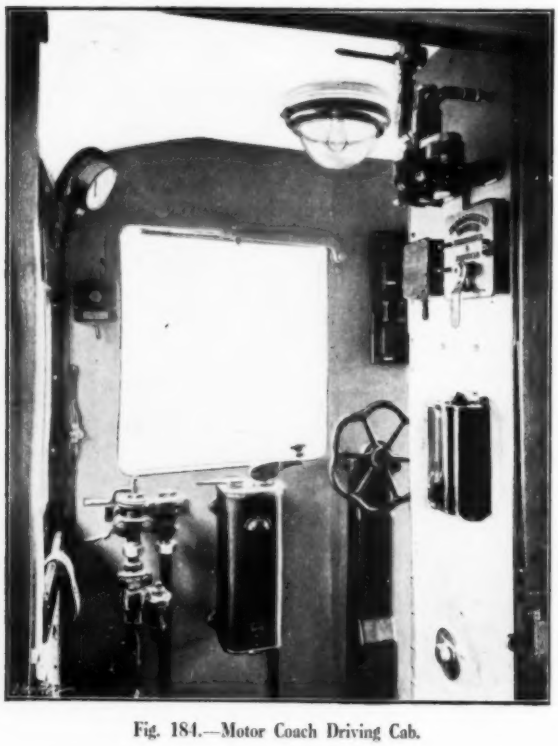

Fig. 184.—Motor Coach Driving Cab.

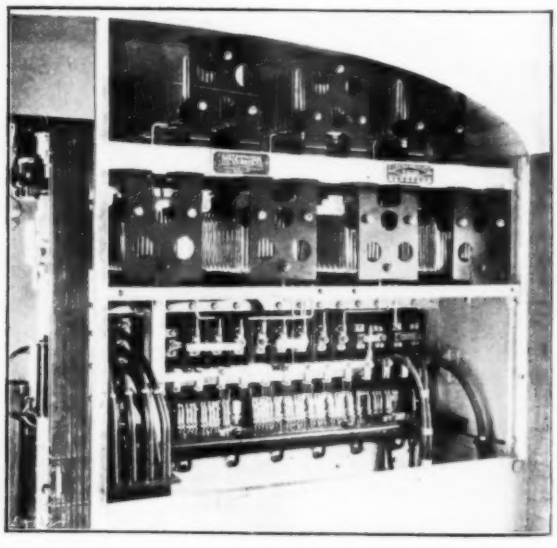

Fig. 185.—Motor Coach Control Equipment.

Immediately opposite the company's stand, there is shown on the stand of an allied firm "Multiple Unit" control equipment for a railway motor coach, with a pantograph collector and an electro-pneumatic main switch panel suitable for controlling

*ELEC. REV., July 18th, 1924; p. 103.

four 220-h.p., 750/1, 500-volt, d.c. motors, all the equipment being mounted in a coach built by the Metropolitan Carriage, Wagon and Finance Co. Part of this exhibit consists of two railway motors, complete with axle bearings, pinions, gears, and gear case, for the London Electric Railway, and the control gear for this exhibit is shown in operation; it is compact and accessible, and being mounted in the driver's cab gives the advantages of cleanliness and convenience in maintenance without the loss of revenue-earning seating capacity.

The system is electro-pneumatic throughout. A number of identical unit switches are built up into a group, and are closed by air pressure; small valves controlling the air are electrically operated from the master controller, the power for this purpose being supplied by a low-voltage motor generator set. The pantograph collector is raised and lowered by air pressure supplied through electro-magnetically operated valves, but is spring supported in its working position. A Westinghouse air brake is fitted, and a 1½-kW motor generator on the underframe supplies current for the control, the lighting, and the compressor motor at a low voltage.

The system is applicable to all types of railway service from 600-volt suburban or tube stock to locomotives operating at 3,000 volts, and equipments are in service over this range of requirements. The "unit" construction makes each element independent mechanically of any other piece of apparatus; this greatly facilitates removal when necessary. The sticking or "freezing" of contacts is eliminated; the closing pressure on the unit switch contacts is about 100 lb., while the throw-off spring applies a force of 80 lb. to open the switch, and the low voltage reduces trouble with insulation or arcing in the control circuits. Interchangeability of all renewable parts is assured, and the equipment provides for the automatic acceleration of the motors in series and in parallel, the bridge system of transition being employed. Multiple operation of coupled coaches is provided for by multipoint couplers between coaches.

The master controller has three separate drums mounted on one spindle: (*a*) The reverse drum is operated through a crank by the reverse key, and is interlocked with the main handle so that the former acts as a key for locking the controller and prevents unauthorised persons from operating the train. (*b*) The cut-off drum is connected in series with the control supply, and is operated by the main handle; the latter must be kept depressed during running, constituting the "dead man's" handle feature. (*c*) The main drum is moved by the main handle directly and distributes the control supply to the various train-line wires operating the switches. The first notch connects the motors in series with all resistance in circuit; the second brings the limit into action, and the resistance is cut out automatically until full series is reached; the third position switches the motors into parallel with all resistance in, the limit still remaining in circuit, resistance being again cut out automatically until full parallel is reached. The driver may remain on any resistance notch by moving the master controller handle back to the first position. All the interlocking and energising features of the master controller are mechanical, and the only two springs in the controller are both of the compression type.

The pantograph consists of a tubular metal framework, on the upper extremity of which two collector pans are flexibly attached. The arrangement of cranks and springs produces a very even pressure on the overhead line, the total variation in pressure throughout the normal working range, whether rising or falling, in no case exceeding 10 lb. It is possible by a simple adjustment to vary this pressure to average anything between 10 and 40 lb. Renewable copper wearing strips are provided, and all joints which might carry current have been shunted with copper braid. The pantograph is carried on four heavy porcelain insulators, each of which is tested at a pressure of 7,000 volts.

The "Unit" switch is controlled by an electro-pneumatic valve taking about 12 watts. When closed the pressure between the contacts is 100 lb., thus ensuring low contact resistance. The wiping action of the main contacts helps to keep the contacts clean, and tends to hold the arc on the tips; additional arcing horns are provided, and the arc shield can be removed entirely to give access to the switch.

The reversal of the fields of all the motors is done by valves controlling the air supply to two cylinders, in which operate pistons that communicate their motion to a drum through a rack and pinion. The latter is attached to the main shaft, on which is mounted a bakelite drum having segments on it and fingers mounted on steel bars insulated with bakelite micarta bear on the segments.

The overload relay has a series-actuating coil connected in the main circuit. When an overload occurs, the coil attracts an armature which causes a spindle to rise, attached to which are cup-shaped disks. The disks bridge fingers in the control circuit which actuates the line switches, with the result that these fall out when the overload occurs. A reset coil energised by the control and a reset switch are included. The limit switch is of the series solenoid type arranged to break the progression circuit of the contactors when the current in the motors exceeds the predetermined value for the accelerating current. When the control circuit is closed, the fingers are bridged by a cup-shaped disk mounted so that when closed good contact is ensured by light spring pressure, and when open the disk is free to rotate under vibration and so presents a fresh surface to the fingers at each operation.

Lighting and Power Notes.

(*Continued from page 252.*)

Maidstone.—ELECTRICITY SUPPLY.—The Town Council has referred to a special committee an application for a supply of electricity to the two factories at Burham of the Associated Portland Cement Manufacturers, Ltd. The amount required is 2,500 kW at each factory, and the estimated capital outlay involved is £93,100 for the following:—Buildings, £7,500; plant, £49,000; mains, £36,600.

Newcastle (Staffs.).—YEAR'S WORKING.—The accounts of the borough electricity undertaking (engineer: Mr. A. J. C. de Renzi) for the year ended March 31st last record a total revenue of £10,306, as compared with £9,599 in the previous year. Working expenses amounted to £5,208, as against £4,708, leaving a gross profit of £5,098, as compared with £4,891 in 1922-23. The net profit amounted to £705 (£1,074). The electrical energy sold increased by 12½ per cent. A new 500-kW rotary converter was brought into commission in December last.

New Zealand.—HYDRO-ELECTRIC DEVELOPMENT.—Referring to the hydro-electric development in New Zealand, the Minister of Public Works recently stated that the number of Power Boards in the country was 36, covering an area of 56,414 sq. miles. In connection with the Arapuni hydro-electric scheme, he said that the original tender included £130,000 for foreign material, but this had been reduced to £64,000. Application had been made for a loan of £440,000, including £300,000 for material manufactured in Britain under the power station plant contract.

Pontardawe.—SPECIAL ORDER.—The Rural District Council has applied to the Electricity Commissioners for a Special Order authorising it to supply electricity in the rural district.

Price Reduction.—BARKING.—Lighting: Over 50 kWh per quarter, from 7d. to 6d. per kWh.

Rotherham.—YEAR'S WORKING.—The borough electrical engineer (Mr. E. Cross) reports that the income of the electricity undertaking for the year ended March 31st last was £239,075, as compared with £210,607 in the previous year. Against this was charged a working expenditure of £105,668, as compared with £80,639, leaving a gross surplus of £133,407 (£88,075), to which was added bank interest amounting to £780, making a total of £134,187. After payment of capital charges, a net profit of £41,225 remained, as compared with a surplus of £38,002 in 1922-23. It is proposed to dispose of the profit as follows:—Extinction of deficit accumulated during previous years, £7,113; contribution to capital outlay, £19,821; to renewals fund, £14,291. The total number of consumers connected increased from 3,253 to 3,574, and the total connections from 40,145 to 44,974 kW. The sales of energy amounted to 55,902,874 kWh, an increase of 16,289,448 kWh.

Southport.—LOAN.—The Town Council has applied to the Electricity Commissioners for sanction to a loan of £35,000 for the provision of a boiler house and equipment at the electricity works.

Sowerby Bridge.—ELECTRICITY IN BULK.—Having considered the offers of Halifax Corporation and the Yorkshire Electric Power Co. for a bulk supply of electricity, the Urban District Council has provisionally accepted the terms offered by the Corporation.

Stone.—ORDER REVOKED.—The Minister of Transport has revoked the powers of the Stone Gas and Electricity Co., Ltd., under the Stone Gas and Electricity Act, 1914, with regard to the supply of electricity in the urban district and parish.

Torquay.—INAUGURATION OF POWER STATION.—The Corporation's new power station at Newton Abbot is to be formally inaugurated by Sir John Snell on September 16th.

LOANS.—The Town Council has applied to the Electricity Commissioners for sanction to the borrowing of £5,000 for mains and services, and £2,000 for meters.

Weymouth.—YEAR'S WORKING.—The report of the borough electrical engineer (Mr. G. Nicholson) for the year ended March 31st last shows a total income of £25,761, as compared with £27,665 in the previous year. Working expenses amounted to £17,819, as against £17,325, leaving a gross surplus of £7,942 (£10,341). After deducting capital charges there was a net profit of £2,392, as compared with a surplus of £4,631 in 1922-23. During the year £2,277 was spent on capital account. The electrical energy sold increased by 120,106 kWh to 1,431,808 kWh, and the price per kWh obtained fell from 4.84d. to 4.12d. The maximum supply demanded rose from 713 to 782 kW.

Tramway and Railway Notes.

Blackpool.—ALLOCATION OF PROFITS.—The Finance Committee has allocated the profit on the tramway undertaking for the past year as follows:—Rate relief, £15,000; reserve fund, £10,000; permanent way reserve, £15,621; carried forward, £3,000.

Egypt.—NEW ELECTRIC RAILWAY.—The Cairo correspondent of *The Times* reports that it is proposed to connect Cairo with Suez by a standard gauge electric railway across the desert.

The line, which will start from Heliopolis, will take passengers and goods along the old overland route which was used before the Suez Canal was opened. Transit between Cairo and Suez will only take two hours, as compared with the present six hours *via* Zagazig and Ismailia. The line will probably be constructed and worked by the Heliopolis Electric Railways.

Haslingden.—Year's Working.—The accounts of the borough tramway undertaking (manager: Mr. B. Kay) for the year ended March 31st last show a total revenue of £15,302, as compared with £16,860 in 1922-23. Working expenses amounted to £12,891, as against £13,801, leaving a gross profit of £2,411 (£3,059), to which was added bank interest of £92, making a total of £2,503. Capital charges absorbed £2,680, and there was a net deficit of £177, as compared with a profit of £411 in the previous year. The number of passengers carried fell from 2,113,681 to 2,028,583, and the car-miles run increased from 174,597 to 177,498.

Newcastle-on-Tyne.—Year's Working.—Mr. E. Hatton, engineer of the Corporation electric tramway undertaking, in his annual report just issued, states that on January 11th a full year's working of the inter-running between the Newcastle and Gateshead tramway systems across the high-level bridge was completed. 13½ million passengers were carried across the bridge by the tramcars during the year. In October the Byker car-sheds were completed, the expenditure on these sheds and equipment being approximately £100,000. During the year there was a decrease in the working expenses of 1.214d. per car-mile. The net surplus, after paying all expenses and meeting the interest and redemption of capital, amounts to £60,666, out of which £18,423 has been spent on permanent way and power station extensions, and £14,000 contributed towards the relief of the city rates. The average fare per passenger was 1.38d., and the cost per passenger was 0.974d.

South Shields.—Year's Working.—The report on the working of the Corporation tramway undertaking for the past year shows that, after meeting interest and redemption charges, there was a deficit of £1,328 on the tramways and £1,621 on the 'buses. During the year there was a decrease of 1.16d. per car-mile in the working expenses.

Wolverhampton. — Railless Cars. — The Staffordshire County Council has approved of the proposed substitution of a railless car system for the tramway between Wolverhampton and Dudley.

Telegraph and Telephone Notes.

Atlantic Cables.—New Type.—The seven cables between America and Europe which are operated by the Western Union Co. will be reinforced next month by another between New York and the Azores, to provide additional facilities between New York and the Continent. This cable will be the first of a new type, and has been designed, by the use of relays on the continuous principle, to transmit in one direction at a speed of 1,500 words per minute. It is not of the duplex type, and is not therefore capable of simultaneous transmission in both directions; but this is a development that may be expected in the near future. The cable has been constructed by the Telegraph Construction and Maintenance Co., and will be laid by it.—*The Times.*

The "Cyrus Field."—The new twin-screw oil-burning cable ship *Cyrus Field*, which has been built for the Western Union Telegraph Co. by the Société Anonyme des Chantiers et Ateliers de St. Nazaire, was on view on August 8th at the West India Dock. The equipment includes a combined picking-up and paying-out plant, supplied by the Telegraph Construction and Maintenance Co., radio direction-finding apparatus, Sperry gyro-compass, and an electric log. The vessel, which will be permanently stationed at Halifax, Nova Scotia, will be employed in that area to maintain the network of cables of the Western Union Atlantic system, but will at the outset be utilised for work off the coast of Great Britain. It is understood that the tender of the French firm was much below that of British and of other Continental shipbuilders.—*The Times.*

France.—Storm Damage.—Telegraph and telephone communication was restored last week-end, following the damage that was done by a cyclone which swept Eastern France.

United States.—Telephone Service.—An average of a million conversations a day are now carried on over the telephone in the city of Detroit. The American people, who number but 6 per cent. of the total population of the globe, have 63 per cent. of all the telephones in the world. Among the 48 States that make up the United States of America, there are 26, each of which has more telephones than the entire kingdom of Italy.—*T. & T. Age.*

Radio Notes.

Birmingham.—Experiments.—A series of experiments is to be started at the Birmingham broadcasting station with the object of improving the general standard of broadcast reception. A receiving set will be installed in the studio and a loud-speaker will be placed opposite the microphone so that reception can be broadcast. Then while the transmission is going on, various circuits will be tried alternately, and various components, such as valves, used. In this way listeners will be able to note the immense difference in the quality of reception caused by the use of right or wrong components, or the various circuits that are now popular, and thus they will have a guide to getting the best out of their own sets. The experiments will be conducted by Mr. Colin Gardiner, of Stourbridge, a Midland amateur.

Plymouth.—Broadcasting under Difficulties.—A fire broke out in a basement under the Plymouth broadcasting station on Saturday night, August 9th, and the fumes threatened to bring the programme to an abrupt conclusion. The staff, however, were able to carry on their work. Meanwhile, the firemen had to wear gas-masks in consequence of the thick smoke.

Radio Exhibition.—An All-British Show.—The National Association of Radio Manufacturers has arranged to house the All-British Radio Exhibition, which is due to be held from September 27th to October 8th inclusive, in the Royal Albert Hall.

United States.—"Wired Radio" Broadcasting.—A summary of the results obtained during two years' experimental work in "wired radio" broadcasting over electric light distributing systems is given in the July 26th issue of the *Electrical World*. A two-channel service has been developed, and the indications are that it will be possible to broadcast at least three programmes simultaneously over any electric lighting system. The transmitting apparatus is connected to the three-phase, 60-cycle, 2,300-volt power line through protective tuning condensers at a sub- or generating station; the receiving set is connected to the consumers' 110-volt lighting mains through a pair of wires and plug. A fundamental idea of the scheme is the renting, instead of selling, of the receiving equipment.

Frequencies varying from 100,000 to 30,000 cycles per second (wave length 3,000 m. to 10,000 m.) were employed, of which those in the neighbourhood of 60,000 cycles (5,000 m.) apparently yielded the best reception results. The radiation from the lines, or "radio effect," decreases rapidly as the frequency is decreased. The effect of the presence in the lines of induction voltage regulators is that the series winding exercises an appreciable choking effect upon the high-frequency current at all frequencies. This could be eliminated, however, by connecting in parallel with this winding a series circuit comprising an inductance and capacity tuned to the transmitting high frequency. A condenser alone was found to be ineffective. With the transmitting apparatus connected to the line side of the regulator the choking action was used to advantage to prevent absorption of high-frequency energy in the switchboard wiring and connected power apparatus.

Two types of receivers have been developed; the crystal detector has only a single adjustment, while the loud speaker contains two steps of audio-frequency amplification. The plate and filament energy are obtained from the 110-V a.c. or d.c. source. The extreme simplicity of the receiving apparatus, the facts that it can be plugged into any light socket in any room requiring no aerial, that no storage batteries are required, that there is no interference from static or other stations, and that the apparatus is "serviced," operated greatly in favour of wired radio. There is a tendency toward unequal distribution of the high-frequency current over the primary feeders and a diminution of signal strength at night, which has been overcome by controlling the amount of high-frequency power admitted per feeder at the command of the operator and by raising the entire power level at night. Within a few weeks it is expected that three-programme operation will be commenced on Staten Island and subsequently on other lighting systems. Connecting fan motors, vacuum cleaners, flat irons or similar apparatus to the 110-volt lines does not diminish the signal strength or produce undesirable noise, provided that, in the case of rotary apparatus, there is no sparking at the commutator. Connection of a heater unit or other type of low-resistance, non-inductive load reduces the strength of the incoming signals.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Ashton-under-Lyme.—August 25th. Tramways Committee. Nine single-deck and one double-deck railless trolley vehicles. Mr. C. L. Baker, general manager.

Australia.—Melbourne.—October 20th. Agent-General for Victoria. Morwell power scheme. Specification No. 24/68, 22,000-V insulators. (August 8th.)

BRISBANE.—September 1st. City Electric Light Co. 150,000-V testing transformer.—*Reuter's Trade Service* (Melbourne).

Bedford.—September 3rd. Electricity Department. E.h.p. and other transformers. (See this issue.)

Cheadle.—August 18th. Cheadle and Gatley U.D.C. Erection of sub-station in connection with electricity scheme at Grove Lane, Cheadle Hulme. Specifications and forms of tender from Mr. Wordingham, engineer, 33, Brazennose Street, Manchester.

Dublin.—August 19th. City Council. Two electrically-driven air compressors, &c. Specification from the City Treasurer, Exchange Buildings, Lord Edward Street, Dublin.

August 27th. Port and Docks Board. Two 2-ton electric wharf cranes. Mr. Joseph Mallagh, engineer to the Board, East Wall, Dublin.

Edinburgh.—September 1st. Electricity Supply. One 10,000-kW turbo-alternator with surface condenser and duplicate set of air and water-extracting pumps. (August 8th.)

August 30th. Tramways Department. Six complete top-covered car bodies. Specifications from the tramways manager, 2, St. James's Square, Edinburgh.

Faversham.—September 1st. Electricity Department. Rearrangement of the existing switchboard and supply and installation of new switchgear. (See this issue.)

Haslingden.—September 5th. Haslingden, Rawtenstall, and Bacup Outfall Sewerage Board. Alterations and additions to machinery. (See this issue.)

India.—INDIA STORE DEPARTMENT, LONDON.—August 22nd. 75-kW and 38-kW crude-oil engine dynamo sets, with static balancers, and water-cooling plant.

September 1st. Madras Corporation. Five miles twin 7/.048 and two miles twin 7/.064 paper-insulated, lead-covered and steel tape armoured cable suitable for pressures up to 660 V a.c.—*Reuter's Trade Service* (Bombay).

London.—ST. PANCRAS.—August 26th. Electricity Department. E.h.p. switchgear. (See this issue.)

Manchester.—August 28th. Electricity Committee. Electrically-driven air compressor plant and pipework, pipework for high- and low-pressure drains, and five 125-kVA, two 250-kVA, and three 500-kVA transformers. (August 8th.)

Morley.—August 25th. Town Council. Electrician's work required in erection of 48 houses, Middleton Road site. Plans and specifications may be seen at Borough Engineer's Office, Town Hall.

Newport (Mon.).—August 25th. Corporation Electricity Department. 10,000-kW turbine, &c.; 10,000-kW turbo-alternator, &c.; and surface condensing plant, &c. (August 1st.)

New Zealand.—WELLINGTON.—October 28th. Switchgear, including 6,600-V oil switches, for the Lake Coleridge Power Scheme.*

CHRISTCHURCH.—October 21st. City Council. Electrically-driven pumping plants. (Ref. A X 1,220).*

October 7th. Taranaki Electric Power Board. Transformers. (Contract No. 43.)*

WAIRERE.—Electric Power Board. October 7th. Small hydro-electric plant.*

Port Talbot.—September 3rd. Borough Council. Electricity generating plant, underground mains, transformers, and meters. (August 8th.)

Salford.—August 23rd. Electricity Department. Coal supplies for 4 or 6 months from September 1st, 1924. Particulars from Borough Electrical Engineer, Frederick Road, Salford.

South Africa.—JOHANNESBURG.—September 10th. Municipal Council. H.p. cubicles.

September 8th. Electricity Supply Commission. Establishment and and working of an undertaking in the Witbank district of the Transvaal Province for the supply of electricity to the Victoria Falls and Transvaal Power Co., Ltd., and consumers within a 15-mile radius of the proposed generating station. The undertaking is to include, in the first instance, a generating station of 60,000-kW capacity. Tender forms (£10 10s.) and particulars from the Electricity Supply Commission, 82, Marshall Street, Johannesburg.—*S. A. Mining and Engineering Journal.*

September 26th. Rand Water Board. Two centrifugal pumps and motors. (Contract No. 258.)*

September 15th. South African Railways and Harbours. Electric cables and wires for 12 months.—*S.A. Mining and Engineering Journal.*

STELLENBOSCH (CAPE PROVINCE).—September 5th. Municipal Council. Complete electric lighting and generating plant.*

Stalybridge.—August 25th. Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board. Structural steelwork required in erection of new Hartshead power station. Specifications, &c., from Messrs. W. H. George & Son, architects, 7, Warrington Street, Ashton-under-Lyne.

Warrington.—September 1st. Electricity Department. Twelve months' supply of earthenware conduits. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Bedwas.—Bedwas Navigation Colliery (1921) Co., Ltd. Accepted:—

Siemens gasfilled lamps.—Siemens & English Electric Lamp Co., Ltd.

Belgium.—International competition was again experienced last week by the Belgian State Railway authorities in Brussels for a small contract for armoured cable, tenders being received from one Dutch, one Danish, two French, four Belgian, and three British concerns, the last being Metropolitan-Vickers Electrical Co., Ltd., Callender's Cable and Construction Co., Ltd., and the British Insulated and Helsby Cables, Ltd. The lowest offer was that of the Nederlandsch Kabelfabriek, of Delft, Holland.

Birkenhead.—The Corporation proposes to install an automatic telephone system in the Town Hall at an estimated cost of £504 per annum (effecting an approximate saving of £49 per annum on the present system), this price being quoted by the Relay Automatic Telephone Co., Ltd. At the meeting of the Council a complaint was made that competitive tenders had not been obtained. The Committee explained that it recommended the offer of the Relay Automatic Telephone Co., Ltd., that firm having submitted a scheme. The Committee did not want to rush any matter through the Council, and accordingly withdrew the recommendation in order that competitive tenders might be obtained.

Derby.—Education Committee. Accepted:—

Installing electric lighting at schools (£282).—Mr. H. F. T. Mitchell.

L.M. & S. Railway. Accepted:—

Boiler flue-cleaning installation.—British Vacuum Cleaner and Engineering Co., Ltd.

Finchley.—Urban District Council. Accepted:—

Complete sub-station equipment for three sub-stations, excluding h.p. switchgear (£5,427).—Hewittic Electric Co., Ltd.

H.p. switchgear at the generating station and three sub-stations, including extensions to the existing h.p. busbars (£1,344).—A. Reyrolle and Co., Ltd.

H.p. feeders, pilot protection and telephone cables, l.p. cables, feeder pillars, &c. (£8,918).—Callender's Cable and Construction Co., Ltd.

Gloucester.—City Council. Accepted:—

Additional feeder cables: 57,110 ft. of l.p. cables (£8,299).—P. E. Banting, Ltd. (agents for E. F. Phillips Electrical Works, Ltd., Montreal, Canada).

The Electricity and Light Railways Committee reported that the tender was £1,823 less than the next lowest, and that the firm had guaranteed that practically the whole of the materials, with the exception of the copper, would be manufactured in Great Britain.

Hastings.—Town Council. Accepted:—

Switchboard for the new generating station (£5,248).—Ferguson, Pailin, Ltd.

Holland.—ROTTERDAM.—Municipal Council. Messrs. Yarrow & Co. (1922), Ltd., inform us the Council has decided to install the latest type of Yarrow boilers, one fitted to burn pulverised fuel, with air heaters and superheaters, in connection with the plant extensions at the power station. The boilers will be built by Messrs. Yarrow's licensees, the Koninklijke Maatschappij "de Schelde," of Flushing.

Hull.—City Council. Contract for tramway rails.

With further reference to our note on page 187, ELEC. REV., August 1st, at a meeting of the Council last week, the recommendation of the Tramways Committee to place an order for 1,500 tons of tramway rails, &c., with Messrs. Bolckow, Vaughan & Co. at £17,936, was rejected, and the contract was given to the Equipment and Engineering Co., Ltd. (London), whose quotation was £3,000 lower, and was for material of German manufacture.

The Tramways Committee, previous to its recommendation to place the order in England, received a letter from the Middlesbrough firm stating that it understood that the foreign tenders were £2 per ton less than the English price. The letter pointed out that British manufacturers had been unable to meet foreign competition owing to the fact that the workmen abroad worked longer hours, viz., 57½ to 60 hours per week, as against 40 hours in this country, and the wages paid to German workers were equivalent to 30s. per week. The letter went on to say that if such a state of affairs was allowed to continue, many of the iron and steel mills of this country would be compelled to close down before long. The Committee, after consideration of the letter, recommended the acceptance of Messrs. Bolckow, Vaughan's tender.

According to *The Times*, the action of the City Council is viewed with considerable gravity by Sheffield steel manufacturers, and the Lord Mayor of Sheffield, Ald. A. J. Blanchard, is reported to have stated that they had protested against that sort of thing through the Chamber of Commerce on a previous occasion. It was very bad business at the present time for a large and important municipality like Hull to place steel orders abroad in view of the great amount of unemployment in all centres of the steel industry. Mr. R. W. Matthews, ex-Master Cutler of Sheffield, said it was a peculiar thing that the Hull Labour councillors, representing, one presumed, the national Labour party, supported the idea of sending the order out of the country. It was impossible to see how their attitude could be justified, for it was deliberately taking wages out of the pockets of British working men and giving them to foreigners. If they carried the action of Hull to its logical conclusion, they might as well cease manufacturing in this country altogether under present conditions.

London.—GENERAL POST OFFICE.

25,000 No. 1 Leclanché porous cells, and 150 protectors.—Edison Swan Electric Co., Ltd.

ST. MARYLEBONE.—Electric Supply Committee.

Wiring work on two blocks of tenements, Fisherton Street, to provide for a conduit run in each tenement scullery for a cooker point and the wiring for cooker points during the main installation or subsequently. Conduit runs for cooker points, £20. Wiring for cooker points:—When on site for lighting installation, £2 10s.; when special visits have to be made, £3 2s. 6d.—Gillham & Jones. (Accepted.)

Wiring staircases and courtyards at the undermentioned properties:—Ashland House, £11; Nightingale Street Buildings, £83; Ossington Street Buildings, £73.—H. J. Cash & Co., Ltd.

Berkeley Buildings, £35; Mitre Buildings, £133.—Ridout & Ratcliff, Ltd.

Crawford Buildings, £29.—Gillham & Jones.

East Street Buildings, £95.—Electric Productions, Ltd.

Nottingham.—Electricity Supply Department. Accepted:
Boiler flue-cleaning plant.—British Vacuum Cleaner and Engineering Co., Ltd.

Pwllheli.—Board of Guardians. Accepted:—
Installation of electric light at the Institution (£445).—Mr. Pierce Jones.

Salford.—Tramways Committee. Accepted:—
H.d. electrolytic copper trolley wire.—British Insulated & Helsby Cables, Ltd.

Education Committee. Accepted:—
Electric lighting installation at 61, Shakespeare Street.—Ford Electric Co.

Electricity Committee.
Requirements during the period ending December 31st, 1924:—
Switches and fuses (in connection with hired cookers).—J. H. Tucker and Co., Ltd.; Tok Switches, Ltd.
Electric cooking ranges.—Jackson Electric Stove Co., Ltd.
Electric kettles.—Metropolitan-Vickers Electrical Co., Ltd.
Requirements during the period ending June 30th, 1925:—
Time switches.—Venner Time Switches, Ltd.; Horstmann Gear Co., Ltd.
Potential and current transformers.—Ferranti, Ltd.
Meters.—Ferranti, Ltd.; Chamberlain & Hookham, Ltd.; Aron Electricity Meter, Ltd.; Measurement, Ltd.; Landis & Gyr, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.
Materials for 12 months:—
Insulators.—Doulton & Co., Ltd.; Bullers, Ltd.; Gaskell & Grocott (six months only); J. Macintyre & Co., Ltd.; Electric & Ordnance Accessories Co., Ltd.
Service boxes.—Forrest & Sym; J. Needham & Sons, Ltd.; J. Stubbs, Ltd.; Sykes & Dyson, Ltd.
Auto-transformers and balancers.—General Electric Co., Ltd.
Trifurcating boxes.—British Insulated & Helsby Cables, Ltd.; Forrest and Sym; Johnson & Phillips, Ltd.; Siemens Bros. & Co., Ltd.; Sykes and Dyson, Ltd.
Dry batteries.—Ever-Ready Co. (Great Britain), Ltd.
Dynamo brushes.—F. W. Potter, Ltd.
Fuse boxes.—Siemens Bros. & Co., Ltd.; General Electric Co., Ltd.; Callender's Cable & Construction Co., Ltd.
Street lighting lanterns, globes and lampholders.—Cable Accessories Co., Ltd.; General Electric Co., Ltd.
Battery for electric vehicle.—D.P. Battery Co., Ltd.
Busbar, sectionalising switches, and two 33-kV feeder equipments.—British Thomson-Houston Co., Ltd.
Three house service voltage regulators.—Metropolitan-Vickers Electrical Co., Ltd.
Three 33-kV feeder equipments and one busbar 33-kV section switch.—Ferguson, Pailin, Ltd.
One 6-kV control panel and one 33-kV feeder equipment.—A. Reyrolle and Co., Ltd.
New slip-rings and brush gear and spare armature for existing rotary converter.—Metropolitan-Vickers Electrical Co., Ltd.

Public Health Committee.
X-ray apparatus for Baguley Sanatorium.—Watson & Sons, Ltd.

Housing Committee.
Electric lighting installations.—E. L. Bellhouse & Co.; R. Seddon & Sons.

Shanghai.—Forty-three tenders were submitted to the Shanghai Municipal Council Public Works Department for electrically-driven pumping plant for the automatic sewage pumping stations which will shortly be built in Shanghai. The concerns tendering included, as well as the well-known British manufacturers, firms in America, Switzerland, Belgium, Sweden, Holland, and Japan. The contract has been placed with Messrs. Inniss & Riddle; it is for B.T.-H. electrical equipment. We print the following list of tenders from the *Shanghai Municipal Gazette*:—

Firm Tendering.	Pumps.	Motors.	
Westinghouse Electric Co.	Byron Jackson	Westinghouse	G$152,864
E. W. Langdon & Co.	Wood Trash	,,	G$152,980
Eastern Engineering Works	Gwynnes	G. E. C. Birm.	£94,236
MacAndrews & Forbes Co.	Drysdales	Vert. S.C.	—
Shewan, Tomes & Co.	A. C. F. C. Belge	,,	£21,499
*Inniss & Riddle	Stereo. to 6" H.S.L.V. above	B.T.H.S.C.	*£19,111
,,	Drysdales	,,	18,791
Scott, Harding	Stereophagus	Parkinson S.R.	30,875
,,	,,	,, S.C.	29,997
,,	Stereo. A.V.H.S. L.V.	Parkinson S.R.	18,530
,,	,,	,, S.C.	17,757
*Jardine Eng. Corporation	Sunturbo	,, S.C.	*11,396
,,	Stereophagus	M.V.S.R.	30,551
,,	,,	M.V.S.C.	29,617
,,	,,	Parkinson S.R.	30,366
,,	,,	Parkinson S.C.	29,440
British El. Eng. Corp. China	Solovane	Mather & Platt	17,180
Arnhold Bros.	Rees-Roturbo	M.V.S.C.	Tls.105,619
,,	Flexala	,,	Tls.136,069
,,	Stereophagus	,,	Tls.179,830
Racine & Cie	Sulzer	Oerlikon	£21,069
,,	,,	Brown-Boveri	17,038
Rose, Downs & Thomson	Blackstone	Eng. Electric	22,863
S. Stone & Co.	Sunturbo	Parkinson	10,670
Gwynnes	Gwynnes	G.E.C. Birm.	19,215
Drysdales	Drysdales	B.S. Spec. S.C.	15,162
Pulsometer	Stereophagus	M.V.S.R.	27,581
,,	,,	M.V.S.C.	26,735
,,	,,	Parkinson S.R.	27,749
,,	,,	Parkinson S.C.	26,352
,,	Stereo. & A. V. and H.S.L.V.	M.V.S.R.	15,556
,,	,,	M.V.S.C.	14,642
,,	,,	Parkinson S.R.	14,823
,,	,,	Parkinson S.C.	14,393
Mitsubishi Shoji Kaisha	Mitsubishi	Mitsubishi	—
†Mee Yeh Handels Co.	No details	—	—
Swedish Trading Co.	Luth & Rosen	Luth & Rosen	—
American Trading Co.	Allis Chalmers	Allis Chalmers	G$143,615
G.E.C. of China	Drysdales	G.E.C.	£16,871

*Authority has been granted to settle with these tenderers for a combination of their schemes at a total approximate cost of Tls.98,000. Messrs. Inniss and Riddle to supply electrical apparatus only and the Jardine Engineering Corporation pumps and piping.
†Detailed tender received too late for consideration.

South Africa.—JOHANNESBURG.—Rand Water Board. Accepted:—
Coal elevators for the Zwartkopjes pumping station (£1,950).—Reunert and Lenz, Ltd. (for five coal elevators with ten shutes manufactured by the New Conveyor Co., Ltd.).
Twenty tenders were received from 14 firms ranging from £1,675 for locally made elevators to £2,992 for imported elevators.

High Commissioner's Department. Accepted:—
Two 4-ton electrically-driven portal jib cranes for Cape Town (£5,489), and two 5-ton electric travelling portal cranes for graving dock (£5,470).—Stothert & Pitt, Ltd.
One 10-ton electric travelling port crane (£3,624).—Sir W. Arrol, Ltd.

Municipal Council. Accepted:—
Cooling tower equipment (£6,690).—Reunert & Lenz, Ltd.
Turbo-generator foundations (£3,375).—Jas. Thompson.
Pipework and valves (£2,412).—Reunert & Lenz, Ltd.
Cooling tower structures (£22,300).—J. Thompson.
A.c. reverse power relays (£144).—Metropolitan-Vickers Electrical Co., Ltd.
Electric cable.—Telegraph Manufacturing Co. (Colonial), £284; Siemens (S.A.), Ltd., £11,731.
Oil switches (£199).—British Thomson-Houston Co., Ltd.
Recording ammeters (£337).—Siemens Bros. & Co., Ltd.
Electric tramcar motors (£7,250).—Siemens (S.A.), Ltd.
Tram track material (£4,612).—Hadfields, Ltd.; (£927), R. Hudson & Sons.
S.A. Power Engineer.

Wrexham.—Town Council. Accepted:—
Two 250-kW rotary converters (£2,357).—English Electric Co., Ltd.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names of makers or suppliers of:—

ELASTUMEN Cables.
REFRIGERO electrical refrigerator.
GIBSON patent terminals.
"100 per cent." earthing clips.

Notes.

Electric Lift Standardisation.—In connection with the article on the subject of electric lifts in recent issues, it is interesting to learn that a commission appointed by the Société Suisse des Ingénieurs et des Architectes is considering the question of the introduction of standards in connection with the construction and operation of lifts with the object of reducing the risk of accidents.

Referring to the same article, in which the author stated that there was practically no literature on the subject, Messrs. Chapman & Hall, Ltd., point out that they recently published a comprehensive book entitled "Electric Lift Equipment for Modern Buildings," by Ronald Grierson. Some months ago we published a review of this book, which is almost the only one of its kind, and is a very excellent practical treatise.

Educational.—The following awards have been made in connection with the City and Guilds of London Institute at the Harris Institute, Preston:—Higher National Certificate and Diploma by the Institution of Electrical Engineers—Gordon H. Pimbley, who has obtained distinction in electrical engineering drawing; J. Bennett, S. Hadfield, D. Kay, and L. K. Platt. Ordinary Certificate—J. M. Ashcroft, J. E. Askew (distinction in mathematics), H. J. Fraser, H. Greenall, H. Jackson, J. Morris, F. W. Roberts (distinction in mathematics and electro-technics), J. E. Salisbury (distinction in mathematics), G. E. Waters (distinction in electro-technics, both a.c. and d.c.). Magnetism and Electricity—Grade 1, First Class: J. Webb; Second Class: J. Statham. Electrical Engineering (Final): First Class: G. H. Pimbley; Second Class: J. Bennett.

Decreasing Fire Risks with Electricity.—According to the report of the National Board of Fire Underwriters, the one possible agency causing fires to show a downward trend—every other chief cause of fires having exacted a rapidly increasing toll—is electricity. The electrical fire losses in the U.S.A. in 1922 were scarcely any higher than seven years ago, despite the fact that the extension of electric service has been so marked that the electrical energy consumed in 1922 was more than 2½ times the quantity in 1915. To-day, substantially half the dwellings of the country employ electric service, while in 1915 the proportion was not more than a quarter. As the country has increased in population about 10 per cent. in the interval, the *per capita* record is even more favourable to electricity. While the *per capita* loss from all fires has increased 2½ times, the *per capita* loss occasioned by fires of electrical origin is substantially less than 80 per cent. as serious as in 1915. The insurance interests now state that there is no safer form of light, heat and power—when properly installed and used. So from the viewpoint of safety too, electricity can't be beat.—*Electrical Merchandising.*

Inquest.—An inquest was held on David Landau, electrical engineer, of Camberwell, at Tonbridge, Kent, on August 11th. He was found drowned in the Medway; a verdict of suicide was returned.

Accident at Sea.—Mr. L. R. Hickman, of Gillingham, chief electrician artificer of the warship *Repulse*, is reported to have been drowned on Sunday night at Halifax, Nova Scotia, through the capsizing of a canoe.

Omnibus Lighting.—The efficient lighting of motor omnibuses has presented difficulties, chiefly due to the limited capacity of the accumulators used and the large discharge rates which accompanied the use of vacuum lamps, resulting in decreased voltage and inadequate illumination. The problem has been solved by the application of "Osram" gas-filled lamps to omnibuses owned by Messrs. Thomas Tilling, Ltd. Each omnibus it fitted with a total of 18 lamps; eight, in the interior, are special omnibus lamps, 12-14 volts, with an energy consumption of 9.6 watts. The current consumption of vacuum lamps previously used was 1 ampere at 12-14 volts, a minimum power consumption of 12 watts. The use of gasfilled lamps, therefore, decreases the energy consumption by at least 20 per cent. Moreover, a lower discharge rate results in a higher voltage over a certain period of time, and so the illumination is increased. The head, side, and tail lamps on the exterior of the 'bus are equipped with 12-14-volt, 7-watt "Osram" lamps, and the destination boards are illuminated with lamps similar to those used in the interior. Messrs. Thomas Tilling, Ltd., have a fleet of over 300 omnibuses on the London streets, and the whole of them are illuminated with "Osram" gasfilled lamps.

Some New Properties of Molybdenite.—In Scientific Paper No. 486 of the United States Bureau of Standards, W. W. Coblentz states that when molybdenite is heated by thermal conduction or exposed to thermal radiation it exhibits hitherto undescribed thermoelectric, actinoelectric, and photoelectric properties. The first part of this paper gives data on the thermoelectric power of samples of molybdenite obtained from various localities. The observed values of thermoelectric power against copper range from about +700 microvolts through practically zero thermal e.m.f. to −1,040 microvolts. Evidently standard thermoelectric data can not be specified. A new actinoelectric phenomenon is described, consisting of an e.m.f. which is manifested in spots or loci or some samples of molybdenite, when exposed to thermal radiation of short-wave lengths. The polarity of the actinoelectric e.m.f. may be positive or negative in spots which are separated by only 0.5 to 1.5 mm. The spectral actinoelectric effect may be photo-positive or photo-negative, depending upon the wave length of the thermal radiation stimulus. The maximum actino-electrical e.m.f. is usually produced by radiation stumuli of wave lengths between 0.65 and 0.9 μ, and no effect seems to be produced by radiation stimuli of wave length greater than 1 μ. The time for attaining the maximum of the actino-electric response appears to be instantaneous irrespective of the wave length of the exciting radiation.

The photoelectrical effect is manifested as a change in resistance when the molybdenite crystal is subjected to an impressed potential and exposed to light. This change in resistance may be photo-positive or photo-negative depending upon the wave length of the exciting radiation. The photo-electrical reaction seems to be produced by radiation of wave lengths from 0.3 to 2 μ. The time for attaining the maximum of the photoelectrical response is a function of the wave length of the exciting radiation, requiring from one to several minutes, and twice that time for recovery after exposure. However, in the typical class of molybdenite having a low resistance, a low-photoelectrical sensitivity but a high-actino-electrical sensitivity, the spectrophotoelectrical reaction appears to be instantaneous irrespective of the wave length. When there is a close coincidence of the spots exhibiting photoelectrical and actinoelectrical sensitivity, the photo-electric current is amplified or weakened, depending upon the direction of the impressed potential through the crystals. This selective response produces a difference of 1.5 to 2.5 times between the maximum and the minimum photoelectric effect.

Canadian Soapstone.—An outcrop of soapstone found in 1921 near Dryden, Ontario, close to the Canadian Pacific Railway, has been examined by Mr. Hugh S. Spence, of the Mines Branch of the Dominion Department of Mines, who reports that the soapstone is of high grade, fully equal to that imported from Virginia. The Wabigoon Soapstone Company has been formed to develop the property, and will commence operations next year. A second company has been formed to exploit an outcrop near the former. It is anticipated that the cost of the local supply will be little more than half that of the imported material.

The Home Office Industrial Museum.—Visitors to London have been attracted by the notice which indicates that a building in Horseferry Road is the Home Office Industrial Museum, but on inquiry they have found that no museum exists. The explanation, says the *Daily Mail*, is that an enterprise entered upon before the war has never been completed, on the score of economy. It is, however, the intention of the authorities to carry out the project when circumstances permit. In 1913 a Bill was passed through Parliament which, among other things, provided a sum of £25,000 for such a museum, the purpose of which was to provide manufacturers, factory workers, and all persons engaged in industry with an opportunity of inspecting all the appliances, both ancient and modern, sanctioned for use in factories, mines, and the like.

The Society of Technical Engineers.—The S.T.E. has on its register a number of qualified electrical engineers who require new appointments. They include engineers desiring posts as technical correspondents, H.O. and B.O. salesmen, inspectors, estimators of works costs, designers, and in connection with general electrical schemes. Information as to vacancies will be welcomed on their behalf by the Society at 102, Belgrave Road, London, S.W.1, from which particulars of the qualifications, &c., of the engineers concerned can be obtained.

Water Power in the Canadian Mining Industry.—A report prepared by the Dominion Water Power Branch of the Canadian Department of the Interior shows the large extent to which water power enters into the mining industry of the Dominion. Taking the industry as a whole (coal, metal, clay products, &c.), a total of 513,500 h.p. is employed, and of this hydro-electric power represents 277,600 h.p.; 44,400 h.p. is generated by the industry's own undertakings, while the remainder is purchased. The chief place in mining as well as in the utilisation of water power is occupied by Ontario, and a great part of the business of the Northern Ontario Light & Power Co., and the Northern Canada Power Co. is the supplying of electricity to the mines. The principal undertaking carried out by a mining company for its own purposes is that of the International Nickel Co., which develops 21,300 h.p. in two stations on the Spanish River. The Mond Nickel Co. generates 9,600 h.p. for itself, and there are several other important stations of the same nature. The Hollinger Consolidated Gold Mines, Ltd., has a 24,000-h.p. undertaking in hand on the Abitibi River, as previously mentioned in our pages.

Fire at Halifax Electricity Works.—On Saturday last a great deal of inconvenience was caused in Halifax by an interruption of the electricity supply on account of an outbreak of fire at the Corporation's power station. The fire appears to have originated in a subway in which there were between 20 and 30 cables, the majority of which were damaged. The fire was extinguished by the fire brigade before it reached the engine room, and the plant was untouched. The tramway system was deprived of power, and the cars were returned to the depôt by means of energy supplied from Huddersfield; and a theatre and several kinemas had to close. It was stated that the damage would not be completely repaired for two or three days.

New "Underground" Car.—A new type of passenger car is being introduced on the District Railway. The ventilation and lighting have been improved, and the car allows more "elbow room" to passengers. The entrance and exit of traffic are facilitated by doors of extra width, upon which are fitted a new type of safety catch and an indicator showing whether the door is locked or not. The interior fittings are artistically executed, and the comfort of passengers has been considerably enhanced by the upholstering of the seats. These cars are to be delivered at the rate of four a week until the order for 50 is completed.

Appointments Vacant.—Shift Engineer (£400) for the Government of Nigeria Electric Light Department. Mechanical and electrical engineer (£E550+) for the Government of Palestine, Public Works Department. Assistant telegraph engineer ($400 per month; dollar=2s. 4d.) for the Government of the Federated Malay States. Shift engineer for the Manchester Corporation Electricity Department. Lady demonstrator for the Manchester Corporation Electricity Department. Switchboard attendant, for the Walthamstow U.D.C. electricity department. Engineer to run a suction-gas electricity station (£350), for the Municipality of Mafeking, S.A. Charge engineer, for the Ashton-under-Lyne Corporation electricity works. (See our advertisement pages to-day.)

New Electric Lamp Specification.—In the new British Standard Specification for Normal Type Tungsten Filament Electric Lamps (No. 161-1924), the basis of the rating of lamps has been changed, the life performance being based on candle power maintenance throughout life, whereas in the previous specification (No. 133-1921) it was based on initial performance with a limited reduction in candle power and efficiency. Another important change is the use throughout of lumens as well as candle power. When No. 133-1921 was prepared, the use of the term "average candle power" was decided on in preference to "mean spherical candle power," but the British National Committee of the International Illumination Commission recommended that this term should be discontinued and the old term revived, as the term "average candle power" had not come into use, and had proved misleading, and the B.E.S.A. has adopted this recommendation.

The figures for the vacuum lamps show that a substantial tightening up of the limits for candle power has been introduced. With regard to the figure for the gasfilled lamps, this part of the specification has been prepared in response to repeated and urgent requests which have been made to the Association. The limits given are necessarily wider than those allowed in the schedules for vacuum lamps, owing to the fact that the present state of the art is not so fully developed, but the values included represent the best British practice, and will be revised as soon as further development makes this possible. In view of the change in the basis of computing the life test, an appendix has been included, setting out an example of computation of life performance which should be useful to those making the tests.

Copies of the specification may be obtained from the B.E.S.A. Publications Department, 28, Victoria Street, S.W.1, price 1s. 2d. post free.

Tramways and Road Repairs.—In the course of an article dealing with the operation of electric street railways, which recently appeared in the Canadian *Electrical News*, Mr. A. H. Foster, manager of the Brantford Municipal Railway, said with regard to the road maintenance obligations imposed upon tramway undertakings:—"In the days when macadam roads and horse-drawn vehicles were more common than at present, the electric car had a high speed relatively to other forms of traffic, and for this reason the track allowance could be considered almost as a private right of way, other vehicles usually confining their movement to the sides of the road and away from a possible source of danger. In these circumstances the railways paid perhaps a not unfair portion of the roadway costs.

"With the advent of the automobile and permanent roads, conditions have changed greatly. The street car has become one of the slow-moving vehicles, and the track allowance is used to as great, if not a greater extent, than the remaining portions of the street. To-day tracks and car movements in a permanent road present no real obstruction to any form of vehicular traffic, and to force a street railway to pay for the full cost of track allowance paving is an injustice and discrimination against a very important and necessary class of transportation that is not applied in the case of other forms of vehicles. The result of a heavy burden for pavement costs is that the car rider, who can perhaps least afford it, must pay in fares an undue portion of the road costs, in comparison to the automobile rider, or else an inferior class of service must be provided for him, or it may assume such serious proportions that a street railway may have to cease operations.

"In the circumstances, as mentioned, a new apportionment of roadway costs should be gone into with the municipalities and agreed upon. One of our larger railways has, I believe, an arrangement whereby it constructs the track and is reimbursed by the municipality on the basis of the cost per sq. yd. of the remaining portions of the highway. In the matter of maintenance 75 per cent. is borne by the city and 25 per cent. by the railway. While this reasonable condition might not be acceptable to many cities, every effort should be made by argument and education of the people to secure a somewhat similar class of agreement or local legislation."

A Bright Thought.—The Toronto *Electrical News* says that it hears of "a Niagara Peninsula electrical dealer who has uncovered a real washing machine selling idea. Every time he takes his truck out he has an electric washer on board. He goes out one way and comes back another—always. Folks say, "There goes George with another washer. He must be doing a big business."

Will of Mr. B. G. Lamme.—The *Electrical World* states that under the will of the late Mr. B. G. Lamme a trust fund of $15,000 is established, to provide two scholarships for the two most capable students in electrical and mechanical engineering, respectively, at the Ohio State University, Mr. Lamme's *alma mater*. A fund of $6,000 has also been established by the will for a gold medal to be awarded annually to a graduate of that university for meritorious achievements in engineering or technical arts. Another fund of the same amount is created to recognise the accomplishments of technical teachers. A third fund of $6,000 is to provide a medal for award by the American Institute of Electrical Engineers to a member distinguished in developing electrical apparatus.

The High-Pressure Congress.—The Conference Internationale des Grands Réseaux Electriques à Très Haute Tension is making preparations to organise the third session, which will take place in Paris at the end of June, 1925, and will last eight days. Papers should be sent in prior to the session, and the discussions will be in both English and French. M. Tribot Laspière, 25, Boulevard Malesherbes, Paris, the secretary of the Conference, will forward a copy of the detailed programme on application. Among the subjects mentioned for consideration are the production of energy in steam and hydro-electric works, the interconnection of the stations, and the construction and working of high-pressure networks.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

An Australian contemporary, in its June issue, stated that Mr. V. Z. DE FERRANTI, son of Dr. S. Z. de Ferranti, and a director of Ferranti, Ltd., was on a visit to Australia in connection with a world tour of inspection to study electrical conditions in the British Empire. So far he had visited Canada and New Zealand, and, after seeing Brisbane, Sydney, Melbourne, Adelaide, and Perth, was to leave for South Africa.

The Sleaford Urban Council has increased the salary of the electrical engineer, Mr. W. H. WILSON, to £312 per annum, without bonus, on certain conditions.

The Nelson Tramways Committee has deferred consideration of the question of an increase in the salary of the electrical engineer and tramways manager until its next meeting.

The *Industrial Australian and Mining Standard* announces that Mr. C. MISCAMBLE, one of the Victorian Railway Commissioners, has been appointed commissioner of Tasmanian railways. He will assume office on August 1st. His engagement is for three years, at £2,000 a year. Mr. Miscamble has been a commissioner of the Victorian railways for nearly five years. He was a member of the committee which dealt with the problem of suburban railway electrification.

Mr. R. L. MURRAY has resigned the position of supervisory engineer to the Telephone Manufacturing Co., Ltd., of Dulwich, and has joined Messrs. Charles W. L. Lambert, Ltd., as an acting director. He desires to receive catalogues.

Mr. A. J. SHROSEBERY, who recently resigned from the post of mains engineer at Nuneaton on being appointed distribution engineer to the Pooley Hall Colliery, has been presented with a rosebowl by the Nuneaton electricity works staff and employés. Mr. F. J. Bird, station superintendent, made the presentation.

Obituary.—MR. J. R. BAINTON.—Mr. John Richard Bainton, M.I.E.E., A.M.I.E. (Aust.), of the English Electric Co. (Aust.), Ltd., passed away on June 13th, after a few days' illness, at Wentworth Falls, N.S.W. The *Electrical Engineer of Australia and New Zealand* states that Mr. Bainton was one of the founders of the Electrical Association of New South Wales, which was afterwards incorporated in the Institution of Engineers, Australia. Arriving in Australia about 1889, Mr. Bainton was for several years associated with the representation of Messrs. Woodhouse & Rawson, of London. Later he joined Messrs. Edge & Edge, and built and equipped a pioneer electric railway, connecting Brighton-le-Sands with Rockdale. About 1903 he established, with others, the Standard Electric Elevator Co., which afterwards became the Standard-Waygood, Ltd., and subsequently the English Electric Co. of Australia, Ltd. At the same time for nearly 20 years he was the Australian representative of Messrs. Dick, Kerr & Co., until the company became incorporated with the English Electric Co., Ltd., of London.

DR. J. WERTHEIMER.—We regret to record the death, which occurred on Saturday last, at the age of 64 years, of Dr. Julius Wertheimer, Dean of the Faculty of Engineering and Professor of Applied Chemistry at Bristol University.

New Companies Registered.

Prangnell Partners, Ltd. (199,751).—Private company. Registered August 6th. Capital, £1,000 in £1 shares. To acquire the business carried on at Newcastle-on-Tyne as Prangnell Partners, and to carry on the business of electrical and mechanical engineers in all its branches. The first directors are:—N. W. Prangnell, Addiscombe Court, East Croydon, Surrey, engineer; A. P. Pyne, The Rosery, Whickham, R.S.O., engineer (both permanent, subject to holding £100 shares). Solicitor: E. F. Robertson, Newcastle-on-Tyne. Registered office: 90, Pilgrim Street, Newcastle-on-Tyne.

Maybrook Electrical Co., Ltd. (199,685).—Private company. Registered August 1st. Capital, £1,000 in £1 shares. To carry on the business of import and export merchants and agents for the importation and exportation of electrical goods, consulting, mechanical and electrical engineers, &c. The subscribers (each with one share) are:—H. M. Rashbrook, B.Med., 720, Fulham Road, S.W.6; W. F. Mason, 37, Leinster Gardens, Lancaster Gate, W.2, engineer. H. M. Rashbrook is a life director. Solicitors: Donald McMillan & Mott, Stafford House, 14, King William Street, E.C.4.

Flactophone Wireless, Ltd. (199,728).—Private company. Registered August 5th. Capital, £1,000 in £1 shares. To carry on the business of wireless and electrical engineers, and manufacturers of electrical apparatus, and to acquire agencies for the sale of wireless and electrical goods and materials manufactured in Great Britain and elsewhere. The first directors are:—Mrs. F. E. Metcalf, 29, Rossall Road, Harehills, Leeds; H. H. Greenwood, 34, Victoria Road, Swindon, Wilts., surgeon. Qualification, 200 shares. Secretary: H. Hensley. Solicitors: Wright & Atkinson, 18, Cooke Lane, Keighley. Registered office: 1, Holroyd Street, Sheepscar, Leeds.

Official Returns of Electrical Companies.

Hindhead and District Electric Light Co., Ltd.—Issue on June 24th, 1924, of £300 debentures, part of a series already registered.

Bell Battery and Accessory Co., Ltd.—Debenture dated July 30th, 1924, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: F. W. Seligman, 52, New Broad Street, E.C.

English Electric Co., Ltd.—Amended particulars filed on August 1st, 1924, of £1,600,000 debenture stock authorised June 13th, and covered by trust deed dated August 14th, 1923, constituting a fixed and specific charge on all the freehold and leasehold hereditaments of the company, and a floating charge on the company's undertaking and property, present and future, including uncalled capital; the amount of the present issue being £1,250,000. Trustees: Anglo-American Debenture Corporation, Ltd. The above particulars were filed pursuant to order of Court dated July 30th, 1924, in substitution for a document filed September 4th, 1923, which merely constituted a registration of the trust deed. Also issues on various dates from September 7th, 1923, to July 15th, 1924, of £79,916 debentures, part of a series already registered.

Townson & Chadwick, Ltd.—E. L. Price, of Bingley Chambers, 1, Cross Street, Manchester, was appointed Receiver on July 22nd, 1924, under powers contained in debenture dated July 15th, 1922.

Bridgwater and District Electric Supply and Traction Co., Ltd (75,429).—Return dated May 31st, 1924. Capital, £20,000 in 15,000 ordinary and 5,000 preference shares of £1 each. 15,000 ordinary and 2,657 preference shares taken up. £8,785 paid on 6,118 ordinary and 2,657 preference shares (including £10 paid on 100 forfeited shares). £8,882 considered as paid on 8,882 ordinary shares. Mortgages and charges, £18,200.

United Electric Tramways Co. of Caracas, Ltd. (89,642).—Return dated November 5th, 1923. Capital, £200,000 in £1 shares. 170,000 shares taken up. £7 paid. £169,993 considered as paid. Mortgages and charges, £131,600.

Electrical Contracts and Maintenance Co., Ltd. (101,757).—Return dated December 13th, 1923. Capital, £3,000 in £1 shares. All shares taken up. £1,331 paid. £1,669 considered as paid. Mortgages and charges at date of return, nil. Since registered, debenture dated May 30th, 1924, to secure £910.

City Notes.

Marconi's Wireless Telegraph Co., Ltd.

In order to render the company's position more clear, the directors have decided to write off losses and to make such reserves as they consider necessary for all uncertain and doubtful assets of the company, from the general reserve account. Provision has accordingly been made for the following:—The whole of the Russian shares, debts, and securities, and overdue debts from other foreign Governments; depreciation of shares in foreign companies; the writing off of the value of the Clifden and other damaged Irish stations (in respect of which a claim is pending); the writing off of the loss arising from obsolescence; the writing off of losses incurred during 1923, in consequence of depreciated exchanges, on foreign Government securities which have now been sold; and to make a reserve of a sum representing the losses made by associated and other companies proportionate to the company's shareholding. £40,000, part of the expenditure upon research and experiments, has been debited to the Patent Account. The company's claim against the General Post Office was expected to be settled within a few days of the date of the report (August 6th). Arbitration upon the amount due for the use of the company's patents by Government Departments should be commenced by the autumn of this year. The trading balance for the year amounted to £270,038, and after the deduction of debenture interest there remains a sum of £172,543, which is increased by the balance brought forward to £695,815. The profits of the year were adversely affected by the substantial loss on the conversion of dividends earned abroad into sterling; serious losses in the "Marconiphone" department owing to the delay in the granting of broadcasting licences; and the loss of telegraph revenue following the destruction of the Clifden station. The volume of business, however, showed improvement, and has continued to show satisfactory increase during the first six months of the current year. The payment of the preference dividend and 10 per cent. on the ordinary shares is recommended, leaving £408,309 to be carried forward. A number of new and important patents have resulted from Senatore Marconi's new discoveries, and a new system of wireless telegraphy has been evolved which is likely to cause a complete revolution in the world's telegraphic communications.

In conclusion, the report briefly refers to the agreement with the Government for the erection of "beam" stations for communication with the Dominions and colonies. The meeting is to be held at the Connaught Rooms, W.C.2, at noon to-day (Friday).

Tyneside Tramways and Tramroads Co.

The directors' report for the half-year ended June 30th last shows a surplus of receipts over expenditure of £3,453; with a sum of £503 brought forward, the balance available is £3,956. From this is deducted mortgage and loan interest, £1,880, leaving £2,076, which it is proposed to distribute as follows:—Preference dividend, £601; to reserve for renewals, depreciation, &c., £500; leaving £975 to be carried forward. The traffic receipts have shown a decrease of £246, but the running expenses have decreased to a greater extent, £486, giving an increased profit. The half-yearly meeting was held on Tuesday last.

Belgian Company.

The report of the Société de Constructions Electriques de Belgique, dealing with the year ended April 30th, 1924, states that the year was characterised by a progressive increase in the rates of exchange which brought about continual advances in the prices of raw materials and of wages. The costs of production suffered in such a manner that the profits expected at the time of the acceptance of orders for later delivery were not realised. On the other hand, keen foreign competition in the market did not permit of the obtaining for plant sale prices which were in proportion to these increases. Notwithstanding these difficulties, the results were more favourable than in the previous year, the loss having been only 208,000 fr., as compared with 576,000 fr. in 1922-23. The report proceeds to refer to the orders executed at the Liége and Ghent works, and mentions that the works at Herstal are in course of completion, the large machine department being on the point of being brought into operation.

German Electrical Companies.

The *Saxony Works Company*, of Dresden, states that good results were obtained in 1923 through the introduction of compensated asynchronous motors, for which large orders were received. Business at the beginning of 1924 was slight, but then improved, although this situation has not continued. The net profits earned last year have been carried forward.

The report of *Voigt and Haeffner*, of Frankfort-on-Main, whose net profits in 1923 have been carried forward, states that the undertaking was well occupied until the end of the year, and that had it not been for the completion of the extensions of the works, it would have been impossible to have executed large orders for switchboard installations and high-pressure apparatus.

The *Accumulator Works Company*, of Berlin and Hagen, states that restrictions on the production were necessary in 1923 owing to the small purchasing capacity in the home market and the unfavourable influence exercised by large expenses on the export trade. The turnover, calculated according to the quantity of lead worked up, was only slightly more than half of that in the previous year. A revival in business only took place after the mark was placed on a gold basis.

Austrian Company.—The report for 1923 of the A.E.G.-Union Electricity Co., of Vienna states that the competitive capacity of the undertaking declined, particularly in the Succession States, with the result that business suffered to some extent. On the other hand, the company received orders for large machines for industrial works and in connection with the development of the Alpine water powers and the electrification of the Alpine railways. A dividend at the rate of 4,000 crowns has been declared out of the net profits of thousands of millions of paper crowns, as compared with 1,500 crowns in 1922.

City of London Electric Lighting Co., Ltd.—The directors have declared dividends on the first and second preference shares and one of 1s. per share on the ordinary shares (at the rate of 10 per cent. per annum) for the half-year ended June 30th.

W. T. Henley's Telegraph Works Co., Ltd.—Dividend on the preference shares at the rate of 4½ per cent. per annum, less income tax, for the half-year ended June 30th; also an interim dividend on the ordinary shares of 1s. per share, less income tax.

Stock Exchange Notices.—The undermentioned have been ordered to be officially quoted:—

Folkestone Electricity Supply Co.—50,000 ordinary shares of £1 each fully paid, Nos. 1 to 50,000, and 50,000 5 per cent. cumulative preference shares of £1 each fully paid, Nos. 1 to 50,000.

South American Light and Power Co., Ltd.—The net profit for the year ended March 31st last was £24,802. To this is added £3,181, brought forward, making £27,983, which is distributed as follows:—Dividend of 7 per cent.; to reserve, £13,000; carried forward (subject to corporation profits tax), £5,218.

Italian Company.—La Società Italiana d'Elettro-Chimica "Soda," of Rome, is increasing its capital from 21 to 42 million lire.

Brompton and Kensington Electric Supply Co., Ltd.—Interim dividend on the ordinary shares for the half-year to June 30th at the rate of 10 per cent. per annum, free of tax.

Tyneside Electrical Development Co., Ltd.—Interim dividend of 3 per cent. on the preferred ordinary shares, less tax.

Mansfield and District Tramways Co., Ltd.—Interim dividend of 3 per cent., less tax, on the ordinary shares.

County of London Electric Supply Co., Ltd.—At an extraordinary meeting held on Monday last the shareholders approved an increase in the borrowing powers of the directors from £2,000,000 to £4,000,000. It is proposed to issue one-year 5½ per cent. notes at 99½, payable at par, to the extent of £1,500,000.

Stocks and Shares.

MONDAY EVENING.

PROSPECTS of peace continue to have a cheering effect upon a good many of the leading Stock Exchange issues. They serve partially to counteract the holiday feeling, and there is more business doing than the House generally experiences at this time of the year. Declaration of increased interim dividends from some of the electricity supply companies has no particular influence over prices in this department. It is known that the companies are doing exceedingly well, and they are expected to produce bumper dividends in this, which may be the last year of their present freedom of action.

The County of London and its associated companies' Bill came up for discussion in Parliament just before the recess, but its consideration was postponed until the end of October. In the meantime, the companies which require money for extensions are pursuing a wise hand-to-mouth policy in the way of finance. The County company is about to issue 5½ per cent. one-year notes to the extent of a million-and-half pounds at 99½. This is, of course, a banker's security, though many investors will take it up as offering a reasonable rate of interest for a year, having regard to the gilt-edged nature of

the stock. Other companies may follow suit on similar lines. While uncertainty continues to obscure the outlook for the electricity supply undertakings of London, the directors of the various concerns are discreet in taking short views in the matter of raising money.

Interim dividends on ordinary shares, which show no variation from those of last year, are the Brompton & Kensington, City of London, and Kensington & Knightsbridge, all 5 per cent.; and Chelsea, 4¼ per cent. Charing Cross 6¼ per cent. goes against 5 per cent.; the County Company's 5 per cent. is an increase of 1 per cent.; the London pays an interim of 4 per cent. against nil; South London's 3 per cent. compares with 4 per cent., and the Westminster's 5 per cent. with 4½ per cent. a year ago. These figures are all actual. Charing Cross preference are a little better at 17s. 6d. County ordinary fell 2s., and City Lights rose 1s. 9d. to the common level of 47s. 6d. The London Electric new 6 per cent. preference, offered at 5, were eagerly taken, and the price is 3s. 9d. premium.

Electrical manufacturing issues are inclined to be dull. Edison-Swan 5 per cent. debenture is a little easier at 74½. Metropolitan-Vickers preference moved back to 47s. 6d., and the ordinary shares are heavier at 18s. 9d., being none too easy to sell at that price. On the other hand, the telegraph industrials are good, with Henleys 2s. up at 55s. 9d., British Insulated equally higher at 54s. 6d., and Callender's, at 53s. 3d., showing a gain of 9d. per share. Inquiries in the market as to whether dividend increases were expected elicited a negative answer, though it was admitted that something of the kind seems to be anticipated, considering the manner in which the shares are being bought.

Automatic Telephones, after being 28s., went off a trifle to 27s. 6d., and Internationals at 22s. 6d. are not at the top. The Post Office has sent out intimation to some of its telephone subscribers to the effect that the automatic system will come into operation in 1926. These notices are accompanied by a printed dial which has to be fixed on the telephone, and which contains instructions which may be easy to understand when they have been well studied.

The Home Railway market is quiet, although Undergrounds have been in demand. Metropolitans gained 10s. at 81¼, but the feature is the strength of London Electric ordinary, which have risen 5s. to 55s. on dividend hopes. London and Suburban Traction stocks are flat. The ordinary shares changed hands a few days ago at 8d., and the preference at 5s. 6d. are 6d. lower on the week. The company's 4½ per cent. debenture has fallen to 55, though the 5 per cent. "A" stock keeps hard at 86.

Foreign tramway and traction descriptions show little that is of fresh interest, Brazilian Tractions losing ¼ at 52½, while Rio Tramway firsts went back to 93¼ and San Paulo fives to 95. Mexican Light & Power first mortgage bonds dropped 3 to 60½, the recently-issued report failing to reassure holders. British Electric Traction ordinary and preference are both lower, at 91½ and 101½ respectively, on fears, of course, that the threats of a comprehensive strike of electricians may be put into force. Madras Electric Tramways preference gave way a little to 16s. 6d. The Rangoon Electric Company is issuing 50,000 new shares, in the proportion of one new share for every five shares at present held.

The Marconi report brought about improvement in the price of the shares. The company is paying 10 per cent. for 1923, which is better than some of the recent anticipations had feared. The net profit of £172,543 compares with £303,000 of the previous year. The preference get their minimum dividend of 7 per cent., against 12 per cent. for 1922, when the ordinary received 15 per cent. The company has taken the prudent course of writing down various assets, and has drawn no less than £2,335,609 from the general reserve, leaving the latter at £1,650,000. The claim against the General Post Office in respect of war service is expected to be disposed of in a few days, according to the report, which also mentions the signing of the agreement between the Government and the company for the provision of stations between this country and distant parts of the Empire. The drastic writing-off of £2,335,000 is deemed to be prudent finance, and this tidying-up of the balance-sheet has given more confidence. Marconi shares pay 6¼ per cent. on the money at the present price, allowing for the dividend.

Canadian Marconis rallied to 5s. 9d. Radio Corporations are slightly easier at 22s. 6d., and the preferred at 19s. have lost a trifle.

Cable stocks are hard, with Great Northerns a good feature at 27¾, this being 7s. 6d. up. Eastern Extensions recovered to 16¼. United River Plates are better at 6¾. West India and Panama ordinary changed hands the other day at 9d. apiece.

Whitehall Electric new debenture is better at ¼ premium over the issue price of 94, but the new preferences remain dull at 19s. British Insulated 5 per cent. debentures are 2 premium; Shropshire new 5½ per cents. command 4½ premium. British Automobile Traction 5½ per cent. debenture languishes at 3½ discount, or about 91½ for the fully-paid scrip, and Barcelona Traction 6½ per cent. debentures are 3 below the issue-price of 91.

Hopes of a revival in trade, as a sequel to possible peace after the Conference, have led to a better tone in the market for iron, steel and armament shares. The provinces are supporting their local favourites. Rubber shares are steady, with a slightly improving tendency, although business in this market has dwindled to microscopic proportions.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1922.	Dividend. 1923.	Price Aug. 11, 1924.	Rise or fall.	Yield. p.c.
Brompton Ordinary	1	12	10	87/-	—	*£5 8 1
Charing Cross Ordinary	1	14	14½	41/3	—	7 0 5
do. do. do. 4½ Pref.	1	4½	4½	17/6	+6d.	5 2 13
Chelsea	1	10	12	37/6	—	6 8 0
City of London	1	15	15	23	+1/9	6 6 4
do. do. 6 % Pref. ...	1	6	6	23/6	—	5 2 2
County of London	1	10	15	21	−2/-	6 6 4
do. do. 6 % Pref. ...	1	6	6	1½	—	5 6 8
Edmundson's Ordinary	8	7	7	4½	—	4 6 1
do. 6 % Pref.	5	6	6	5⅜	—	5 11 7
Kensington Ordinary	5	12	14	9½	—	7 3 7
London Electric	1	10	10	81/-	—	6 9 0
do. do. 6 % Pref. ...	5	6	6	5⅜	—	5 11 7
Metropolitan	1	8½	10	1⅜	—	6 1 3
do. 4½ % Pref.	1	4½	4½	17/-	—	5 6 6
Newcastle-on-Tyne Ordinary ...	1	2½	6	18/9	—	6 8 1
do. 5 % Pref. ...	1	5	5	17/-	—	5 17 8
do. 7 % Pref. ...	1	7	7	25/6	—	5 9 10
Notting Hill 6 % Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6 % Pref. ...	1	6	6	1⅛	—	5 6 8
Urban Ordinary	1	—	4	18/3	—	4 7 8
do 6 % Pref. ...	1	5	6	1	—	6 0 0
St. James' and Pall Mall ...	5	14½	17½	13⅛	—	6 13 4
South London	1	11	15	43/3	—	6 18 7
South Metropolitan Pref. ...		7	7	1¼	—	5 12 0
Westminster Ordinary	5	12	15	10½	—	7 6 4
Whitehall Elec. Invst. 7½ % Pref.	1	7½	7½	19/6	—	7 13 10

Home Rails.

Central London Ord. Assented Stock	4	4	68½	—	5 16 10	
Metropolitan ... ... ,,	8½	4	81¼	+ ¼	4 18 2	
do. District ... ... ,,	3	3½	50½	—	6 18 7	
Underground Electric Ordinary	10	Nil	Nil	2⅞	+ ⅛	Nil
do. do. "A" ...	1	Nil	Nil	8/-	+6d.	Nil
do. do. Income Bonds	5	6	99	—	*6 1 5	

Telegraphs and Telephones.

Anglo-Am. Tel. Pref. ... ... Stock	6	6	103	—	5 16 6	
do. Def. ... ... ,,	1½	1½	23⅞	—	6 6 4	
Chile Telephone	5	6	6	5½	—	5 9 0
Cuba Sub. Ord.	10	7	7	7	—	10 0 0
Eastern Extension...	10	10	10	16⅛	+ ⅛	6 3 0
Eastern Tel. Ord. ... ... Stock	10	10	10	161½	—	6 3 10
Globe Tel. and T. Ord.	10	10	10	17½	—	5 14 3
do. do. Pref.	10	6	6	11½	—	5 6 10
Great Northern Tel.	10	24	22	27½	+ ⅜	7 18 6
Indo-European	25	7	7	22½	—	*5 6 1
Marconi	1	15	10	5⅝	+ 1/16	6 3 1
Oriental Telephone Ord.... ...	1	12	12	1⅝	—	*6 3 0
United R. Plate Tel.	5	8	8	6¾	—	*5 18 6
West India & Panama	10	Nil	Nil	1/-	—	Nil
Western Telegraph	10	10	10	16⅛	—	6 4 1

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref....	5	12½	5½	8¼	—	8 16 0
do. do. 2nd Pref. ...	5	5½	6	2⅛	—	10 13 4
do. do. 5% Deb. ... Stock	5	5	73½	—	6 16 0	
British Electric Traction Ord.... ,,	5	6	91½	−1	6 11 2	
do. do. 6% Pref. ... ,,	6	6	101½	−1½	5 18 3	
Brazil Traction 100	4	4	52½	— ½	7 12 5	
Brit. Columbia Elec. Rly. Pcs. Stock	5	5	87½	—	5 14 3	
do. do. Preferred ,,	5	90/-	89½	—	*5 5 8	
do. do. Deferred ,,	8	127/-	103½	+1	*5 5 0	
do. do. Deb. ,,	4½	4½	81½	—	5 4 4	
Lond. & Sub. Trac. 5 % Pref. ...	1	5	2½	5/6	−6d.	9 1 10
London United Tram. Deb. ... Stock	4	4	45½	—	8 15 10	
Mexico Trams. 5% Bonds ... —	Nil	5	68	—	7 11 6	
do 6% Bonds ... —	Nil	Nil	45½	—	Nil	
Mexican Light Common ... 100	Nil	Nil	16	—	Nil	
do. Pref. 100	Nil	Nil	42	−1	Nil	
do. 1st Bonds ... —	5	5	60½	−3	8 5 4	

Manufacturing Companies.

Babcock & Wilcox...	1	20	12	48/-	—	*5 0 0
British Aluminium Ord.... ...	1	5	5	25/9	—	3 17 8
British Insulated Ord.	1	15	15	54/6	+2/-	5 10 1
Callenders	1	15	15	53/3	+9d.	5 12 7
do. 6½ Pref....	1	6½	6½	23/3	—	5 11 10
Crompton Ord.	1	5	Nil	⅛	— ⅛	8 17 10
Edison-Swan	4/-	7½	—	8/-	—	6 0 0
do. ,, 5% Deb. ... ... Stock	5	5	74½	−1	6 14 3	
Electric Construction	1	10	10	1⅜	—	6 19 0
English Electric	1	8	5	15/3	—	6 1 2
do. do. Pref.	1	6	6	19/6	—	6 3 1
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
do. Ord.	1	5	5	17/9	—	5 12 7
Henley	1	15	15	55/9	+2/-	5 7 6
do. 4½ Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	10	5	1½	—	*7 5 6
Met.-Vickers Pref....	2	8	8	28	— ⅛	6 14 9
Siemens Ord.	1	5	—	1	+ 1/16	5 0 0
Telegraph Con.	12	20	20	24½	—	*4 17 7

* Dividends paid free of Income Tax.

Consulting Electrical Engineers in Ireland.

By "DELTA."

A GENERATION has passed away since the writer was a contributor to the technical Press.

The world seemed very young in those days, and held much promise for the young men who went into central station practice, in most cases straight from the workshops and drawing offices in which they had served their apprenticeship. In doing so they sacrificed immediate and assured interests; perhaps they had the vision to see that in the years ahead this great branch of the profession was destined to do great things.

The writer is one of that rapidly dwindling brotherhood. It was a hard life, and one lived it under constant strain. We had much to find out for ourselves, and much to teach others. As charge engineers, we saw immense additions to our plant being made almost day by day; our responsibilities were increased—as a matter of fact, almost everything in the nature of service was increased in an astonishing manner. Our pay did not increase. Yet we were joyous and merry souls giving of our best, responding willingly to every demand made upon us, for we felt that what we were doing mattered greatly.

As the years passed the nerve strain, responsibility, and ever-present anxiety involved in the care and management of these large and complex generating systems began to tell, for it requires steady nerve to do these things, as my young friends who are to-day doing shift duty will cheerfully testify. A time came for most of us when that nerve was not quite so steady, and when among the many sounds and noises of engines, dynamos, alternators, rotaries, pumps and other power accessories which go to make up the impressive roar of a great generating station under load, there came to the ever-listening ear the warning note of impending trouble, it may be that we were not so prompt and effective in immediate action as we should have been. Naturally we looked about for something a little more restful. When we got the chance we sought the rural simplicity of the mains, the test room and traction departments. For some of us the kindly doors of smaller systems opened after a time, and we became full-blown chiefs.

At length for others the great day came, and we "opened" offices. With how high a heart and with what abounding hope we did it! Complete in every respect, drawing boards, instruments, reference library, and the magic insignia *Consulting Engineer* on ground glass.

There were some who made their start under the most promising conditions; their chances of success seemed practically assured. But the way led over new ground, and they were pioneers. And to these pioneers the way led onward; there was no going back.

It was then, or about that time, that there came into the world a great many treatises on every branch of electrical engineering. It appears that the solitude of offices and freedom from the cares and worries of practice are highly conducive to the development of the *cacoethes scribendi*. It must have been from these offices that strenuous and purposeful men with brows "sicklied o'er with the pale cast of thought," rushed into the Temples of Science and astonished the greybeards seated within with the weight and abundance and diversity of their knowledge.

The great technical colleges and institutes opened their kindly arms to some. In the security of ordered things there was peace. No longer need one hustle for a living. Those were spacious days, and it was good to think that we had played the game.

It is this question of playing the game which interests the present writer. How is the game being played at the present time? What are the rules as they are written up to date?

For he finds that he has to study them anew. Over five years ago the tide of war in Ireland flung him from his class room. The Local Government Board gave him at the time a Sealed Order for compensation, and he has had to defend it up to the highest court in the land—the Court of Appeal. It is a very nice Sealed Order. He has it still.

He obtained a lesser appointment as a teacher of engineering after some effort in another part of the country. For the wages of a street sweeper in London he taught innumerable subjects, for all of which he had to hold the qualifications of the Examination Boards. At length he found that if he was to follow the traditions of the brotherhood of the old days, there was nothing for him to do but to resign, and go out once more into the highways and byways to make his living by the practice of his old trade. It will be seen why he had to do so later. He is only just starting, and this is his first experience as a consultant who is, at present, unable to equip himself with a ground glass panel on his door.

He was employed by a private lighting and power company to test its plant, and take it over on its behalf after the official test. He tested the plant under full load and the short time overload conditions, and with one exception he found all was satisfactory. He made one mistake, however. In accordance with ancient practice he foolishly imagined that as a consultant he stood for plain, stern, even-handed justice, for the right of things as they are, and refused to believe in the more modern view that a consulting engineer is an unprincipled blackguard hired to use his qualifications and his skill to enable a board of directors, under threats of an action at law, to fleece the contractors. Unfortunately in this case the contractors themselves held the same opinion of consultants and refused to meet him in any way. Like wise men they hastened and made their peace with the supply authorities, and settled everything without consulting him or obtaining his sanction to anything. The company's principal official did the business in such a way that the contractors believed that the consultant was behind the company with an axe. When the directors had driven their bargain with the contractors, they turned round on the poor consultant and told him that he had not done the work for which he was employed, and that they would not give him a penny of his fee. Of course, the writer can engage in expensive litigation to recover his few guineas. A case of this kind might run to a very big figure. Do those contractors realise that they are every bit as guilty of a grave injustice as the company? It all amounts to this—the company was powerful, the consultant was not. He had neither status nor accepted sanctions behind him.

A short time afterwards he was engaged by a rural council to consider some proposals made by a company which wanted to promote a scheme in the area. When the word was passed to it, the promoting company withdrew its proposition.

Something must be done. Any ignorant person may call himself a mechanical and an electrical engineer and set up as a consultant. In Ireland this consultant may also be a wiring contractor, though one or two have had the grace to lay aside their pliers before branching out as consulting engineers under the present genial conditions. They are openly offering their services to corporations, rural and district councils, for the electrification of towns and cities. They solicit, they circularise, they follow up, they have their tentacles and their touts in the committees. Some of them have never been in a central station in their lives. Such a one calls himself an expert. He *is* an expert. Has he not wired houses? The word "expert" is gravely mouthed by

his secret canvassers on the council. "The expert is engaged." He will design the system. Comes eventually some station engineer to take charge and to discover how badly the hand of the potter shook. If he breathes one word of it he will be sent to seek the great open spaces, and he knows it. Can you blame him if he keeps silent? He will put the house in order—there will be no difficulty, money will be forthcoming.

The writer humbly and respectfully asks: Were all those years in central-station practice wasted? Did they contribute one iota to our equipment for our life's work? Is all, or any part of it, necessary? If it is, how comes it that an "expert" who has never seen a main laid, has had no mechanical or electrical training beyond house wiring, has not ever laid eyes on a central station under load, can do these things? Is the expert justified?

If he is, then all that is necessary is a few standard specifications. They are easily obtained. The contractors will supply them. "They will give every assistance." Young men need not crowd into the central station. They need no longer spend laborious days and nights in work and study. Contact knowledge of these things is no longer necessary. Two or three pounds a week and the care of a power station costing a million? Nonsense! Technical education? No use whatever.

Seriously, what are our learned institutions doing? Has not the time come when they will identify themselves more intimately with the profession? What do their grave and laborious papers mean? What if they do light up the dull page of science. The standard-bearers of the light demand a living, for some of them faint by the wayside and are growing weary.

I say that legal status must be obtained, and at once. If he has qualified, if he has served, if he has worked and studied and patiently toiled and spent time and money, if he has made the one great and virile effort of his life in graduating—and if he will play the game, he must be protected. Let all useful and rightful restrictions be imposed, but there must be protection as full and complete as that extended to the members of the legal and medical professions.

In the early days this journal did much to benefit the profession. Its editors have been our friends. The pages of the Review have always been open to all who hated abuse and corruption and who were prepared not only to destroy it, but to prevent its recurrence. The most beneficial results followed, and, occasionally, these results surprised everyone concerned. A few letters in the "Correspondence" columns, and an Association of Mining Electrical Engineers came into being. As one of its promoters, the writer was present at its inaugural meeting and dinner more years ago than he cares to remember.

Although the writer hopes to benefit the legitimate members of the profession who are consultants at the present stage by bringing about their registration under Royal Charter, and to make it compulsory by law that not one penny of public money can be spent without a certificate, he believes that all sections of the profession will come to his aid, and he has no hesitation in asking for it. No one can question the fact that immense difficulties have to be overcome, and these difficulties can only be overcome by the united effort of all. The youngest employé in a central station, the senior and eminent member, the Institutions of Civil, Mechanical, and Electrical Engineers, the various associated bodies and societies, the Manufacturers' and Contractors' Associations—all are directly interested.

He wishes to have the views of all members of the associated branches of engineering as to what should be done, and how to set about it, and he will then ask for representatives from the profession to take up the matter. To succeed, it is necessary that the full force of the profession and industry should be behind us. The writer will be glad to have the moral support of both industry and profession, and invites correspondence both in the journal and personally; in the latter case this will be forwarded direct to him by courtesy of the Electrical Review.

Modern Factory Efficiency.

By "VITAL SPARK."

The rapid spread of knowledge of the fundamental principles of electrical phenomena and their application to the design of dynamo-electric machinery, coupled to the increasingly stringent economic conditions existing within the field of commercial use, has culminated in the diverting of the design of such into more or less standard lines. While specialisation in some particular kind of machine to meet some industrial necessity (*e.g.*, electric welding) may be a fairly remunerative procedure for the manufacturer who has collected exclusive information from experience relative thereto, yet the day has come when it behoves the general manufacturer to institute vigorous research as regards his internal organisation and administration if he desires to meet successfully the competition of rival firms.

We Britishers are notoriously conservative, but even the most hardened "old timer" must to-day realise that among the various departmental activities, there are many opportunities for re-organising and speeding up the output. Since the drawing-office is the source from which emanate all working instructions, it is obvious that the importance of an efficient organisation in that department cannot be over-estimated, and it is proposed herein to tender a few pertinent suggestions.

It is a lamentable fact that while standardisation is the keynote of economical manufacture, the exact significance of the term is not fully comprehended even by some of its enthusiastic exponents. Some there are who, possessing intimate knowledge of design *de novo*, fail to adapt standard machinery to new specifications in a strictly efficient manner. Standards should be kept within certain limits consistent with the working scope of the concern and the nature of the machinery produced; chaotic confusion is the result if special designs are allowed to lead up to a bewildering array of "standards." Where the one-drawing, one-part system is employed, each sketch being accompanied with a table of dimensions referring to a range of machines of various outputs, the method of tabulation should be carefully studied. The convenience of the operator using the drawing must be considered and clarity of construction always aimed at; the elimination of the human element to the minimum results in a decrease of the possibility of error. Embellishments of any kind should be avoided as they may only cause confusion in the mind of the workman.

When issuing instructional details to the works, much time (and incidentally exasperation) can be saved by quoting a comprehensive list of drawings appertaining to the job in hand; the foremen concerned can then pick out the data relating to their own departments. In the small factory the "routeing" of the machine through the shops is part duty of the D.O., and if strict attention is not paid to chronological sequence, delay in delivery is of frequent occurrence. While superficially it appears a comparatively simple matter to maintain continuity throughout the complete process of manufacture, yet even with a monthly schedule, careful planning and wholehearted co-operation between depart-

ments is necessary to attain this object. If stock and current orders are put through concurrently, this difficulty is augmented, and friction between departments is far from conducive to the *esprit de corps* so essential in modern labour concerns. When the works contain only one machine shop, how often is a practically complete machine held up because, say, the bedplate must wait until the planer is free? and so on *ad lib.* Jamming-up of work in this way is the essence of bad management.

A record of blueprints issued to the various shops is nowadays kept in most well regulated factories. The office must know how many prints of a specific drawing have been issued and to which part of the works. It is sometimes necessary to make an alteration in a standard, or a system of periodical examination of drawings may be in vogue, and all drawings must be recalled at some opportune moment when there is no danger of dislocating manufacturing processes. Omitting the cancellation of *all* old issues when alterations are made to the original has been the cause of many costly mistakes. Another point which might be stressed in this connection is the necessity of keeping the blueprint store up-to-date, and the provision of an accurate register of prints. Especially is this the case when duplication is not carried out on the premises, since the lack of a drawing might be felt at a time when haste is the order of the day—a frequent occurrence.

The foregoing has, of course, no claim to completeness, but an analysis of procedure in any particular office will soon render manifest many minor improvements which will tend towards higher efficiency and the establishment of sound industrial prosperity.

Electrical Progress and its Unsolved Problems.

By Prof. ELIHU THOMSON, M.Inst.C.E.

(*Abstract of the "James Forrest" Lecture, 1924, delivered before the* INSTITUTION OF CIVIL ENGINEERS.)

(*Concluded from page* 198.)

IN the rotors of induction motors aluminium offers the constructional advantage that it can be cast in place complete as a so-called squirrel-cage winding upon the laminated iron core, filling the grooves and forming the end rings. While its conductivity for current is, for a given section of conductor, much inferior to copper, this fact is frequently of advantage in the process of starting such induction motors.

In the matter of insulation in electrical machinery or structures, there will always remain room for further advances. The ideal in this respect can be set as high as one pleases, with little hope of attainment. It should be non-puncturable, undestroyed by temperature-elevation, should not allow current to be conducted as by leakage, should be moisture-proof, should conduct heat, and should retain these characters permanently. In reality, the insulation is usually the perishable thing, and may break down from overheating, or puncture, by surges raising the potential differences, and other causes. Evidently the case is one for continual improvement, but always within a limited compass.

Internal-combustion engines, chiefly of the Diesel type, or modifications thereof, have been put into more and more extended use for power-generation from fuel oils. Recently such oil engines have begun to be adapted to the "electric drive" for ships, in the same sense that steam turbines have been applied. History is certainly in the making in this oil-engine electric drive. Sets of combined Diesel engines and dynamos have been successfully installed, and the current, as in the turbo-electric drive, operates the screw shafts, through electric motors, with the same advantages of control. I am told that results recently obtained have shown that a remarkable economy of fuel oil will be realised as compared with oil-burning steam engine plants. Besides the evident advantage of doing away with the boiler plant itself, with all its accessory machinery, waste heat, and uncleanly surroundings is secured. The advantage over coal-burning is still more evident. However, the possibilities of steam and vapour power are not yet exhausted.

Having made allusion to the electric drive for ships, it is proper to mention "gasoline (petrol) electrics," in which, instead of the direct application of the power of the internal-combustion engine, as is usual in automobiles, there is employed an electric intermediary. There is an indication that such plant may find useful application on a considerable scale in the recent production in America of a locomotive, embodying in its make-up a solid-injection-jet multi-cylinder Diesel type oil engine, and direct-connected dynamo generator, the current from which is delivered under control to motors geared to the driving-wheel shafts of the locomotive itself. This development appears to have considerable promise from the fact that it has all the advantages of the internal-combustion engine, combined with the known benefits of electric traction.

It would, of course, be only a slight extension in such a case to furnish current from the locomotive to motors geared to the axles of the cars or carriages themselves, especially where the grades to be surmounted are heavy. As a locomotive engine proper, the combination seems to have a future field of great usefulness, especially in sparsely-settled countries.

An account of electrical engineering progress and possibilities would not be complete without reference, at least briefly, to the application of electricity to railways.

When it came to the electrification of parts of trunk lines, differences of opinion arose as to the employment of direct current or alternating current in the operation of the motors. This is a question which can hardly be said to have been settled, the circumstances of railway work varying widely. It is thought that the question of the adaptability of the various systems may best be answered by a careful study of the conditions of service in each case.

Mr. H. M. Hobart, in his "James Forrest" lecture, delivered in 1915, gave a very able presentation of comparative results, drawn from actual practice. The conditions have not radically changed in the nine years intervening, and his analysis of the situation still remains valid. It has long ago been demonstrated that the substitution of electricity for steam in working long lines of standard railway provides for every condition, and can secure notable advantages. The projects which are, even at this moment, under way, point to a gradual substitution of electricity for steam in high-speed or express service, and it is probable that this will eventually be followed in most cases by its use in freight or heavy goods haulage. The development of water power even at distances of hundreds of miles away from the track will assist the process materially in avoiding the haulage cost, and that of the fuel for the steam locomotives now employed.

Beginning several years ago and growing to a considerable importance in electrical distribution is the practice of establishing completely automatic sub-stations, recent examples of which are:—

The Oregon Electric Railway, an inter-urban line operated at 1,200 volts from seven automatic sub-stations.

The United Railways of St. Louis, Mo., which has five sub-stations of an aggregate capacity of 7,000 kW.

The United Edison Co. and Consumers Power Co. has 13 automatic sub-stations, with a total output of 12,500 kW for the Detroit (Mich.) United Railways.

A similar development is proceeding in Africa for the Moroccan and South African Railways, and for the Melbourne, Australia, railways.

Automatic control of generating stations and of sub-stations even for lighting where the voltage has to be controlled from a distance is a recent notable achievement. It is indeed a safe prediction for the future that the "tying in" of many such remotely, or automatically, controlled stations upon common transmission lines for supply and distribution of electric energy will be a characteristic more and more in evidence.

The problem of providing means for adjusting or correcting the power factor of an electric system of distribution and supply is only existent in alternating-current work. To correct low power factor, devices known as synchronous condensers are employed. The objection to the synchronous condenser as so used is that it is expensive, and, further, that it is a revolving machine, needing oiling and attention, and that it consumes power in the excitation of its magnetic field and involves loss in windage or air resistance.

This brings us to the consideration, at least briefly, of perhaps the most difficult of the problems with which the electrical engineer has to deal, namely, the construction of reliable static condensers.

Constructed of metal foil separated by layers of insulating material which must be thin to insure a charging or capacity of practical value at small expense, and which insulation, though thin, must resist puncture or breakdown indefinitely, even when the applied potential is accidentally increased by surges, the static condenser is indeed an outstanding problem. At the same time it must not be so expensive to construct and maintain as to cancel the advantages of its use.

To obtain the needed current capacity the metal foil sur-

faces must be very large, while any slight defect in the insulating layer between them anywhere over the very extended surface almost surely means a breakdown sooner or later. Such a breakdown is at once followed by a heavy current discharge—a short circuit of the total charged surface of large extent.

The result is evidently the destruction of at least a portion of the condenser, and the immediate need of automatic removal of the destroyed section from the rest of the structure by disconnection. Such a condenser to be practical should stand years of service. The condition in a condenser is one demanding practical perfection over a very large extent of thin insulating layer between the metal foils.

The weak points unfortunately, are not evident except under prolonged use; a slight fault or leak in the dielectric layer leads eventually, under constant stress, to final breakdown.

A procedure which is in fact not a solution is to build such condensers in sections of limited capacity, each section provided with fuses or cut-outs so that sections showing faults may be easily removed and replaced, while the fittest may thereafter survive for a time more or less prolonged. Even with existing imperfections some use has been made of static condensers in improving the power-factors in local distribution, but it must be said that condenser construction and use still present unsolved problems. What progress is to be made in the years to come must be gradual unless there be substituted some better type of construction as yet unfound. In the welding art two important departures have been made in recent years. One is the use of what is known as the "flash weld," and the other is the modification applied, instead of riveting, to sheet metal, and known as "spot welding."

In the flash weld, instead of the metal pieces to be united being brought together firmly or with considerable pressure before passing the welding current through the joint, they are but lightly contacted at the start so that the resistance at the joint is high, the condition being that of partial contact only. The energy applied is thus at first used in a very local heating at the meeting faces, and in the case of a wide plate the prominent parts of an irregular contact edge are burned off so that the pieces become automatically fitted to each other before union. Under this local heating the weld is finally completed by quick heavy pressure forcing them together, which causes extrusion of the very much softened or fused metal out from the joint as a thin fin, easily removed. In this method of manipulation the heating is attended with a shower of sparks from the meeting faces at the weld, namely, the faces to be welded, which are more intensely and more locally heated, and with greater rapidity than in former practice. The result is that the subsequent application of heavy pressure does not cause a bulge at the joint, but merely a thin fin of nearly fused metal easily ground off or cut away. Joints made in this way are far more dependable than formerly, and will stand subsequent cold working well, since the strength at the joint does not differ materially from that of the pieces before joining. A large application of this method of working has been made in recent years, as in the production of steel automobile wheel rims, especially those for heavy trucks. In these the plate may be 16 to 18 inches wide and ¼ inch or more in thickness, making a section of 8 or 9 square inches at the weld.

All resistance welding is naturally benefited by sharp localisation of the heating effect to those portions or faces of the metal pieces to be welded. I may here mention one of the curiosities of the art, at first seemingly anomalous. It is the welding of copper with decided benefit under a stream of water directed on the weld during the heating and formation of the joint.

The benefit obtained in what at first seems a contradictory procedure is twofold: first, entire exclusion of air and prevention of oxidation of meeting surfaces; second, greater localisation of the heating to the joint itself. Copper is such a good conductor of heat and current that when a copper joint is being made requiring a very heavy current, the resistance with the temperature on account of the positive on each side. If, however, the joint can retain its heat while the metal away from it can be kept cool, the rise in resistance with the temperature on account of the positive temperature-coefficient of copper comes into play to secure the result desired. At the joint proper the heat at once rises to the point at which the water poured thereon will not wet the metal. It may take on the spheroidal state, while a little away on each side of the joint the contact of the water is a boiling contact, and further back still a mere cooling contact. This cooling and boiling preserve the conductivity from greatly falling off at those parts of the copper on each side of the joint, for they cannot greatly rise in temperature. At the joint or weld, however, the spheroidal state prevents rapid cooling by the water. The total result is to accentuate the heating at the weld as compared with the metal at each side thereof, and so facilitate fusion and union at the weld itself. In general, the effect is to increase efficiency. There is thus a tendency to impart reliability to an undertaking otherwise uncertain.

It has long been known that the rapidity of work in electric resistance welding has often been limited by restricted energy supply, and that by increase of energy supply operations may be carried on at greater and greater speeds. An example of this is seen in the rapid production of steel tubing by the well-known method of welding a longitudinal seam in which the edges of the skelp are either lapped or abutted to form the pipe. The limitation to rapidity of pipe formation in such case seems to be that at last the welding is only done in spots which in frequency or spacing along the seam, as it is formed, correspond to the frequency of the current supplied, generally 60 cycles. The result of too rapid feed of the pipe through the welder is to make an imperfect pipe, unsuitable as a conduit for gas or liquid, but which, though leaky and imperfect, is still suitable for many steel structures such as bed frames or the like, in which the pipe form gives beam strength or resistance to flexure combined with lightness.

There remains the problem of determining how far, by increasing the frequency of the current used in the welding, the speed of manufacture of steel piping by the process can be increased without producing imperfect welds or leaks at the seams. It is possible that gains in economy would follow, as it is a peculiarity of electric welding such as we are considering that the more rapidly the welds are made the less total energy is required, if the apparatus be suited to the work.

In the past 10 or 15 years that form of electric resistance welding called spot welding has attained very great importance, having widely extended use in metal constructions, chiefly of sheet steel. It is now very extensively employed in uniting the parts of steel railway-car bodies, automobile bodies, sheet-metal containers, and an endless variety of objects the parts of which were formerly riveted or bolted together. There seems to be no discoverable limit to its use on thin metal, but apparatus has also been constructed capable of uniting sheets up to ½ in. in thickness, the joints under test showing advantages over the usual riveting processes. We may confidently look forward to the future extension of this method, to cases where rivets are unsightly and inconvenient.

For certain forms of standard work, as in fusing seams in tanks, arc-welding machines have been developed. Such machines regularly feed forward the welding wire as it is consumed, and also traverse the wire electrode along the line of the seam being welded. Most of the work so far requires close supervision, and hand work predominates, and probably will continue to do so. It is possible, however, that automatic machines will in the future find more and more extended application, especially in standard production or repetition work.

Alternating-current arcs have not the same applicability to electric arc welding as direct-current arcs. The low-frequency arc is liable to become extinguished at the zeros of current. Recently an ingenious proposal to combine with the low-frequency a superposed wave of much higher frequency has been made, it being well known that even with alternating current, arcs at, say, 1,000 cycles per second or over differ little in persistency or continuity from those obtained by the direct current commonly used.

As to the theory of what takes place in an iron arc used with the welding wire, there is at present no agreement; my own view of the case is simple. When an arc is drawn between an iron plate and the welding wire (usually between one-eighth and three-sixteenths in. in diameter), and a current of 150 amperes traverses the arc, the end of the wire at the arc becomes so highly heated that the metal not only melts but vaporises in part at the tip of the wire. The outside or surrounding surface of this tip, while very hot, can, and does, radiate heat rapidly. It must therefore be cooler than the interior or inside metal of the wire at the tip, which is not so exposed as to radiate. The result is an expulsion of the interior metal at the tip by a process akin to explosive boiling, with the projection of iron globules, superheated, against the surface of the plate, towards which the tip of the welding wire is directed.

Hence there is a continuous rain of iron globules upon the work, and the force of this projection is such that arc welds can be effectively made by a skilled operator even directly under the work, or where the work piece is vertically over the arc, as is the case when a repair has to be made to the underside of a tank or boiler *in situ*.

In the Northrup high-frequency electric furnace there is no ring hearth or circuit surrounding a laminated iron core as in the common forms of induction or transformer furnace, but merely a crucible of usual shape in which the metal to be melted and treated is placed. Surrounding the crucible is a jacket of refractory material, and surrounding the latter is a winding made of a copper tube through which during operation water is circulated for cooling.

This copper tube winding is connected into a circuit which gives currents of a frequency such as 20,000 to 50,000 cycles, and which has an energy delivery large enough for the work to be done. A mass of metal in the crucible is thus subjected to induction, acting itself as a secondary to the primary circuit conveying the energy. Heavy currents are induced in the mass (or masses) in the crucible, and it rapidly heats even to fusion, or, in extreme cases, to vaporisation, the highest attainable temperature being only limited by the leakage of the generated heat outwardly or by vaporisation of the metal charge itself, provided that the refractory of the crucible is itself able to resist the high temperature. Up to the present time the frequencies demanded for the operation

of the Northrup furnace, which should equal or exceed 10,000 cycles, are not found in common use as large energy currents, and reliance has now to be placed on their generation by vacuum-tube oscillators or oscillating-arc apparatus. The recent work done in the development of high-capacity power tubes of types similar to those used with smaller outputs in radio transmission work may possibly provide a suitable source of current for working the Northrup furnace.

There is, however, no great difficulty in constructing dynamos of large output yielding currents of a frequency of 10,000 cycles or more.

Synchronous Motor Drives in Refrigerating Plant.

In a paper on this subject, read at the International Congress on Refrigeration, Mr. Truman Hibbard (of the Electric Machinery Manufacturing Co., Minneapolis, Minn., U.S.A.) dealt with the development of the synchronous motor, particularly for driving ammonia compressors, and incidentally for the small air compressors and centrifugal pumps used in ice and refrigeration plants. He said that factors responsible for the rapid increase in the use of electric motors for refrigerating plant were the rising cost of labour and of fuel, and the preferential rate offered by public service companies for synchronous motors in order that they might benefit by the inherent tendency of the synchronous motor to improve the power factor of the distributing system.

The author dealt briefly with the earlier synchronous motor compressor drives, when the motors were belted to the compressors, and further developments leading to the present practice of directly connecting synchronous motors to many types of ammonia compressors in sizes of 20 h.p. and more. Ammonia compressors requiring 20 to 100 h.p. were commonly of the two-cylinder, single-acting vertical enclosed type designed for belt drive; the synchronous motor was designed to be mounted directly on the end of the standard crank-shaft of the compressor, so that the compressor remained standard in every respect. The stator was carried on cast-iron sole plates embedded in concrete. The flywheel pulley formerly furnished for driving the compressor was removed, and the rotor of the synchronous motor mounted in its place. In several designs of this type of compressor the motor thus applied had no outboard bearing, the rotor being overhung. This type had the advantage that it might be applied to any standard belted compressor already in use. In all such applications it was essential that the flywheel effect of the rotor should be of such value as to avoid resonance. For this purpose special flywheel rims were supplied for these small sizes, so that the proper amount of flywheel effect could be obtained by choosing a suitable flywheel rim without changing the design of the standard rotor. The rim was bolted and keyed to the rim of the rotor. By the adoption of this method it was frequently possible to install another compressor in the space formerly occupied by the belt drive.

Within the last year the Electric Power Club and the American Society of Refrigerating Engineers had undertaken to standardise practice with regard to current variation due to pulsating torque by adopting the following rule:—

"When the driven load requires a variable torque during each revolution, such as reciprocating type pumps, compressors, &c., the combined installation shall have sufficient inertia in its rotating parts to limit the variations in motor armature current to a value not exceeding 66 per cent. of full-load current.

"The basis of determining this variation shall be by oscillograph measurement, and not by ammeter readings. A line shall be drawn on the oscillogram through the consecutive peaks of the current wave. This line is the envelope of the current wave. The variation is the difference between maximum and minimum ordinates of this envelope. This variation shall not exceed 66 per cent. of the maximum value of the rated full-load current of the motor. (The maximum value of the motor-armature current to be assumed as 1.41 times the rated full-load current.)"

Emphasising the importance of mechanical balance of compressor and motor, the author said that, with the direct-connected synchronous motor, if all rotating parts were not carefully balanced there might be heavy current variation, even though resonance were not present.

One application of synchronous motors which had proved successful, and in which it was difficult to avoid current variation exceeding 66 per cent., was the mounting of a low-speed synchronous motor directly on the shaft of an existing engine-driven vertical type two-cylinder single-acting compressor. In this type of installation there was no space to mount a separate flywheel, and since the compressor cylinders were single-acting and the speed was very low, the requirement for flywheel effect was large if current variation was to be limited to 66 per cent. In a number of successful applications of this kind the engine which formerly drove the compressor had been removed entirely and the flywheel removed from the centre part of the shaft, and a synchronous motor mounted directly on the shaft in the place of the original flywheel.

The author proposed the use of one motor mounted between two identical independent compressors for small installations, to give flexibility of capacity, with decreased torque pulsations under full load.

In advocating the standardisation of motor voltages, and the avoidance of 220 volts for larger motors, the author said that motors of 440 or 550 volts, or 2,200 volts for sizes over 100 h.p., would usually result in a more efficient plant and a lower first cost.

In advising against the use of compressor motors at leading power factor, he said that the beneficial effect on the power factor of the power system by the use of synchronous motors had in some cases resulted in overdoing a good thing. Rarely would there be a refrigerating or ice plant in which the conditions warranted the use of leading-power-factor motors. It was very rarely that any power company would offer an advantage in rates for leading-power-factor operation. The user was directly handicapping his plant in two ways when operating his motor at leading power-factor, and unless there was present a very bad power-factor condition to be corrected by the synchronous motors, the use of leading power-factor motors would not be warranted. The output of a synchronous motor at 80 per cent. leading power-factor was approximately 70 per cent. of its rating at unity power-factor. Also, the cost of the motor designed for leading power-factor operation, including its excitation, was approximately 10 per cent. more than for the same motor designed for unity power-factor operation. The efficiency of a given motor at 80 per cent. leading power-factor would be three or four points lower than its efficiency at unity power-factor at the same mechanical load. The excitation for operation at 80 per cent. leading power-factor was approximately 65 per cent. greater than for operation at full-load unity power-factor. By using synchronous motors for air-compressors, pumps, &c., the power-factor of the whole installation might be kept above 95 per cent. without operating any of the motors at leading power-factor.

A comparison of characteristics of ten typical synchronous motors for direct connection to compressors was then made, to show the wide variation in characteristics required by present commercial standards. Also, the standardisation of compressor designs and ratings was urged, to reduce the number of standard motor designs, and thus to secure lower costs to the user.

It would seem that the compressor builder might with advantage design single-acting compressors with more than two cylinders, so as to relieve the somewhat difficult situation arising when a customer or the power company insisted that the current variation should be very low and that all the flywheel effect should be within the motor. Also, increasing the speed of the single-acting compressor would very materially aid in supplying the user with a compressor unit meeting his wishes in every respect without a separate flywheel.

The Commercial Engineer.

By Frederick W. Pope.

The term "Commercial Engineer" seems almost to contradict itself, yet it would be difficult to find one which better describes the position of engineers who have gained positions on the commercial side. No one need be contemptuous of such a term; James Watt was a commercial engineer. He first made and then sold what he had made.

Here we would consider how the ambitious engineer of to-day might follow him. How, having spent some of his best years in the workshop and a considerable amount of his spare time at the technical school, can a man hope to gain sufficient knowledge of business to fit him for a business appointment?

Some of the more fortunate youths entering the trade will have been guided to a course of study embracing commercial practice. Many of these only receive practical training as part of a plan to fit them for executive positions.

Our present concern is with men having no such advantages; men to whom the practical work of the shop is the first introduction to engineering. Many such men, reaching an age at which they are able to review their outlook, find themselves left behind by others who may have had just the "little more" advice which makes the difference.

We would presume that every engineer who desires to enter commercial life has spent at least five years in the workshop, and that he has received such training as evening classes are able to give, in machine drawing and design and mathematics. What must he then do?

It would be well for him to decide this before he is twenty-one, so that he may at that age endeavour to get some commercial experience in an office. He may return to the factory or may get into a technical department later, but it is important that he should early appreciate the purpose of the various commercial sections of an organisation. If he cannot afford to do this he might take a commercial course, but experience will serve him well whether he takes a course or not.

What position is he aiming for? There are two which stand out as being particularly suitable: Sales representative and works accountant.

For the first of these positions, he ought to have enough knowledge of book-keeping to enable him to appreciate such questions as occasionally arise. He must have a clear idea of the meaning of debit and credit in the book-keeping sense. He will probably be expected to estimate as well as to travel, and this will demand a thorough knowledge of the product he is selling and a familiarity with railway and shipping practice. He will have to dictate letters, and let him beware of books on commercial correspondence! Anyone who knows what he is writing about ought to know how to write it clearly and persuasively. Let your letters be your own!

For a works accountant a much higher knowledge of book-keeping and accounts is required. Though he might never be asked to keep a full set of books, the works accountant should be able to do so, and further, to work to trial balance and balance sheet. Costing should be, of course, his first subject.

Filing systems, for statistical matter or correspondence, have to be considered with all other matters of office routine.

The commercial engineer will soon find that he is up against one of the drawbacks of a mathematical training. He will not always have time to "work it out," but will often have to make a quick decision on the moment.

The engineer who becomes a business man must be ready to adapt himself to the ways of business.

Trade Conditions in Norway.

Mr. C. L. Paus, C.B.E., Commercial Secretary of the British Legation, Christiania, has furnished a report to the Department of Overseas Trade upon industrial and economic conditions in Norway.*

In the introduction to his report, Mr. Paus states that a banking crisis early in 1923, and continuous labour disputes, have retarded progress towards Norway's economic recovery. Notwithstanding this, however, improvement occurred in the degree of activity in various branches of industry, unemployment was reduced, and the volume of foreign trade increased. Foreign competition caused inconvenience to manufacturers for the home market, but increased import duties and the rising prices on the Continent, especially in Germany, have improved matters considerably. Both trade and industry were stagnant at the date of the report owing to a labour conflict. More stable conditions were, however, expected to accompany the settlement of this dispute, and the lighter tone which prevailed in January encouraged traders to take a hopeful view of the future. In view of the increased Customs duties, it would appear that Norwegian manufacturers will be the first to benefit by any improvement in demand, but the higher level of prices for Continental products should enable British exporters to compete more successfully for the trade which may go to foreign countries. The report reviews the efforts made by the Government to restore public confidence in the banks by a system of public administration in the cases of banks forced to cease payment. This proved detrimental to the banks themselves, and the law was amended in certain respects. During 1923 the value of the krone fluctuated considerably, and at the end of the year it stood at 27.50 to the pound sterling as against 25.40 at the end of 1922.

Water Power.

The Commission appointed by the Norwegian Government in 1918 submitted to the Ministry of Public Works in 1923 a technical plan for the organisation of the supply of electricity throughout the whole of Norway. The Commission recommends that the supply of power for distribution from electricity works shall be made a public enterprise administered, under State control, by the various county councils and town councils. It is not, however, proposed to interfere with persons or concerns who have made or may make arrangements to procure electrical energy from their own power stations. Direct action in providing power is to be taken by the Government only in exceptional circumstances, as, for instance, in the case of Finmarken, where extraordinary conditions render it desirable that the State should assume responsibility for the whole electricity supply, but it is suggested that the State shall bear a certain percentage, varying in different parts of the country, of constructional costs. The Commission has further drawn up plans for the supply of power to all railways in the South of Norway.

The report of the Commission has been submitted for consideration to the different town and county councils and to the Board of Watercourses and Electricity.

No operations which involve the harnessing of new water power were commenced in 1923. Work has, however, proceeded on the completion of State and municipal power schemes initiated at an earlier date, largely with a view to domestic service. It may be mentioned as a characteristic feature of development during the past year that much progress has been made in the establishment of inter-connection between existing power stations, with a view to the best possible utilisation of energy which is already available.

Tunnelling operations have been continued at Nore and are expected to be concluded in about a year's time. The date at which the Nore power scheme will be completed depends to a great extent upon the financial situation and the future demand for electrical energy. In 1923 State votes were made of kr. 1,200,000 in aid of the Nore scheme, and of kr. 5,500,000 in aid of the Numedal Railway. The total expenditure hitherto authorised in connection with these enterprises amounts to kr. 27,330,000 in the case of the former and kr. 17,500,000 in the case of the latter.

The construction of a main transmission line capable of delivering 20,000 kilowatts from the Rjukan power station to the municipalities of Christiania and Drammen and the Buskerud county was completed in 1923. Alterations have, however, been made in the power contract, whereby the energy from Rjukan is to be utilised during the winter only, on the basis of payment at the rate of kr. 10 per kilowatt-year, plus 33 öre per kilowatt-day of actual use, and, as a matter of fact, the transmission line has hitherto been employed solely for the delivery of power which has become available through the inter-connection of other power stations in the south of Norway.

The scheme to harness the Solbergfos on the River Glommen will probably be completed in 1924. It will be recollected that this scheme is expected to yield 50,000 h.p., of which one-third will be taken by the State and two-thirds by the municipality of Christiania.

Among municipal power schemes, the power station at Raanaasfos, which was taken into use in 1922, is now loaded to its full capacity, and it has become necessary to rent power from other stations for night service.

The Bergen Municipal Power Co., having arranged to increase its contract for the delivery of power from A/S Bjölvefossen, has decided to retard the contruction of a 100,000-h.p. station at Dale, whence energy will not be required until 1928.

The scheme to harness the Safjord watercourse in the Romsdal County and that of the Nord Tröndelag County to harness the Folla watercourse were completed and put into commission during 1923. Owing to financial difficulties, no progress was made in 1923 with the scheme of the Aalfot Power Co. to develop the Aalfot waterfall. Other schemes which are in hand are the Heggmo station, Bodin (7,000 h.p.), and the Fredrikshald scheme 10,000 h.p.), while the Troms County has recently brought 2,000 h.p. from the Bardo waterfall into use. During the year the Ministry of Public Works was authorised to expend up to 3¼ millions of kroner in aid of municipal power schemes in cases of financial difficulty.

The Export of Hydro-Electric Power.

The Commission appointed by the Norwegian, Swedish, and Danish Governments to consider means for transmitting power from Norway to Denmark, submitted a report and an estimate of costs in 1923. It was found that the technical difficulties could be overcome, and four different schemes were discussed, of which technical opinion appears to favour a.c transmission by overhead lines through Sweden and over the Sound. The scheme is unlikely to be realised in the near future, however, owing to the high cost of material and the fact that Denmark cannot at present absorb the minimum quantity of power necessary to render the scheme economically practicable. The section of the Commission which deals with the legal and administrative aspects of the question has not yet completed its investigations.

General Trade Conditions.

The report states that a slight recovery occurred in the demand for machinery, tools, and engineering supplies, but the market remained small owing to financial and labour difficulties and remaining stocks. The demand for iron and steel and non-ferrous metals, though much less than normal, improved during the past year. Norwegian manufacturers dominated the market for semi-manufactured non-ferrous metal products, such as zinc sheets, copper, brass and aluminium sheets, rods, tubes, and strips, and copper and aluminium wires and cables. A law passed in July, 1923, authorised the Crown to determine that the importation into and sale in Norway of material for radio-telegraphy and telephony should be rendered subject to special concession, but no use has yet been made of this authority. The registration of trade marks by commercial associations for the use of their members was the subject of a law passed in July, 1923. The period of the validity of patents has been extended from 15 to 17 years, and higher fees have been introduced. Insulators and electric cables have been subjected to the "gold rate" of import duty.

The Electrical and Allied Industries.

The engineering and shipbuilding industries generally have had to contend with a shortage of orders, poor prices, and keen competition at home and abroad. Mechanical and electrical workshops have suffered from industrial stagnation and

*Stationery Office. Price 2s. net.

the cessation of hydro-electric schemes. Some factories have been engaged upon the construction of electric locomotives for the State railways, as well as railway cars, but it is stated that the increased protection afforded by import duties has been insufficient to counterbalance the high costs of production. The demand for new supplies of electrical machinery was very small in 1923, and German firms secured, as in recent years, the bulk of the business, except in the case of transformers, for which the majority of orders were placed with Norwegian manufacturers. No contracts for large machinery were given to British or American firms. At the end of February, 1924, German prices displayed a rising tendency, and, owing to the uncertainty of delivery from Germany, buyers seem disposed to place their orders in Norway whenever possible. French manufacturers are reported to be now in a position to quote competitive prices for transformers and rotating machinery. Most of the trade in both high- and low-pressure cables has also been carried off by Germany, but some orders for both have gone to France. Norwegian factories do a fairly good business in domestic heating and cooking apparatus, for which there is a steadily-increasing demand, but Swiss competition is serious. The demand for the products of the electrochemical and electrometallurgical industries showed a slight improvement in 1923, German competition in export markets having practically disappeared. The exports of aluminium were twice as large as in 1922—12,778 tons as compared with 6,177 tons—while the present rate of production is estimated to be between 15,000 and 20,000 tons per year. The production of zinc fell, but a French company, which has contracted for 20,000 h.p. of electrical energy, is to commence producing zinc at the rate of from 1,000 to 1,500 tons per month during the present year.

Railway Electrification.

A great deal of railway construction is in hand or in prospect. Experiments have been carried out with two German petrol-engined bogie passenger cars with a view to testing them for short sections where traffic is small. The electrification of the Ofot railway from Narvik to the Swedish frontier (about 40 kilometres) was completed in July, 1923, when the line was formally opened for electric traffic. Work was commenced last year on the electrification of the line from Bragerōen (just outside Drammen) to Kongsberg, and of the section of the Hovedbane between Christiania and Lillestrōm (21 kilometres). No decision has yet been reached with regard to the electrification of other sections of railway.

Foreign Trade.

Details of Norway's exports and imports are given in appendices to the report. The import table does not classify electrical goods separately, but under the general heading "Machinery" the total value of imports is given as kr. 38,222,443, as compared with kr. 36,538,000 in 1922. The export figures are more detailed, and from these it is seen that electric motor exports improved from 9,519 kg. to 20,427 kg.; generators and dynamos, however, are shown as *nil*, comparing with 683 kg. in 1922. Telephone and telegraph apparatus is set down at 10,658 kg., as against 18,732 kg. Two not wholly electrical items are: "Hoists, elevators of all kinds," 30,201 kg., as against 46,295 kg., and "Cranes, discharging and loading apparatus, winches," 124,436 kg., as against 78,851 kg.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The B.T.-H. Electrical Tachometer.

In most cases where it is required to know the speed of revolution of rotating machinery, a reliable and convenient method of obtaining such information is by means of an electrical tachometer. Equipment of this kind comprises a small d.c. generator, with permanent magnets, connected to an indicating instrument of the permanent-magnet coil type, the instrument having a scale graduated in revolutions per minute. The generator is mounted in any convenient position near the machine the speed of which it is desired to measure, and may be either coupled direct or driven by means of a belt or gearing; it is not necessary that the generator should run at the same speed as the machine. The instrument may be of the indicating or recording type, or both types may be operated simultaneously from the same generator; alternatively, more than one instrument of the same type may be installed. With a generator operating under the above conditions, the speed-voltage characteristic is practically a straight line, resulting in a uniform scale over the whole range of the

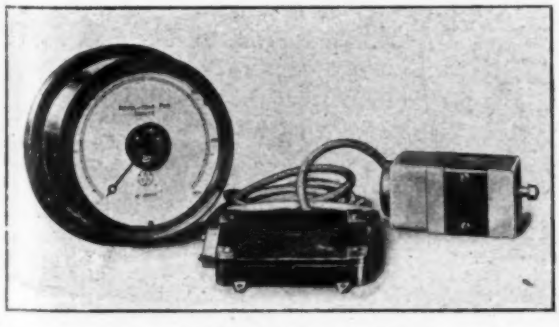

Fig. 1.—Electrical Tachometer Equipment.

indicator. Errors due to changes of temperature met with in practice are negligible, as a resistance of large value and having a negligible temperature coefficient is connected between the generator and the instrument to act as a ballast. The indicating or recording apparatus may be installed away from the machine, and the provision of a scale having a central zero enables it to discriminate between directions of rotation. Besides being of small dimensions and simple construction, errors due to vibration are eliminated, and there is no sluggishness or lag. Equipment of the kind described has been provisionally patented by the British Thomson-Houston Co., Ltd., of Coventry, and is illustrated in fig. 1. The generator, built on similar lines to a motor-car lighting set, is entirely enclosed and robust.

The C.A.V. Loud Speaker.

The loud speaker illustrated in fig. 2 is a production of Messrs. C. A. Vandervell & Co., Ltd., Acton, W.3, and it is said to possess several features which engender improved effi-

Fig. 2.—The C.A.V. Loud Speaker.

ciency. The swan-neck of the horn is a solid aluminium casting, as is also the base. The diaphragm is held in such a manner as to prevent all movement except that due to the action of the magnets. The entire absence of moving parts,

the adjustment of the diaphragm being strictly parallel to the magnets throughout its whole range, permits very clear reproduction. Three patterns are made with windings equivalent to 120, 2,000, and 4,000 ohms respectively. The two high-resistance patterns may be placed directly in the anode circuit of the valve, but the 120-ohm size requires the employment of a step-down transformer.

The "Wootton" Lantern.

A portable electric lantern designed especially to meet the requirements of the Metropolitan Police has been produced by Messrs. S. SMITH & SONS (M.A.), LTD., Cricklewood Works, N.W.2. This lantern, which is illustrated in fig. 3, has a die-pressed case of 18 s.w.g. aluminium, which, being in one piece, is proof against leakage of acid. The container is fitted with springs shaped to grip the accumulator cell and prevent movement or damage. The cell has seven plates enclosed in celluloid, and its construction is such as to give high efficiency with low weight. It has a capacity of 7 Ah (actual) which is sufficient to provide for a ten-hour continuous run. The separators are of specially-prepared wood and a non-spillable

Fig. 3.—The "Wootton" Lantern.

vent is provided. The terminals are surrounded by vaseline-filled channels to guard against corrosion. The switch contacts are situated in the stream-lined front of the lantern and are therefore adequately protected from acid fumes, &c. All contacts are of the self-cleaning rubbing pattern, ensuring certainty of operation. The main contacts are carried on the lid of the lantern. This lid is retained by catches and is easily removed. The lamp is of the centre-contact miniature bayonet cap type and it is fitted so as to facilitate replacement. A focusing arrangement is provided to enable either dispersed or concentrated beams to be obtained. If desired a specially-designed dry cell can be used in the place of the accumulator. The company has also produced a charging board for use with these lanterns in "unit" form for building up to any size according to the number of lanterns to be dealt with.

Repairing Burnt-out Commutators.

A rapid method of repairing burnt-out commutators has been evolved by the MICA MANUFACTURING CO., LTD., Bromley, Kent. This is effected by the use of "Micagel," which is mica reduced temporarily to a semi-colloidal or plastic state in which it can be pressed between the segments of the commutator by means of a spatula. In a very short time, it is claimed, the plastic mica becomes solid, so that the machine can be put into commission again with little delay. The company states that when set, "Micagel" has all the qualities of mica of the highest grade, *viz.*, the same degree of hardness; freedom from anything of a gritty nature; the same high insulation value; non-inflammability; and its efficiency is in no way impaired by contact with acids, alkalis, oils, or water. Half-an-hour is the time stated for the completion of a repair with this preparation.

Electricity v. Steam in Oil Well Drilling.—Working with a crew having no experience of the electric drive and finishing work at the same time as a near-by steam-drilled well, the economy of using electricity for oil-well drilling was recently demonstrated by the San Martinez Oil Co. in the Signal Hill field, Long Beach, California. In spite of lost time at the start, due to the inexperienced crew, the electrically-drilled well was completed 38 days after starting work. During the entire performance at the electrically-drilled well not a single accident of consequence occurred, whereas there were a number of "twist-offs" and expensive accidents at the steam-driven well. The electrical equipment consisted of a 75-h.p. motor on the draw-works and rotary table, a 50-h.p. motor on the slush pumps, and a small motor on the blower, as well as electric lights, all furnished by the General Electric Co., U.S.A. The power cost at the San Martinez well was $601 for 38 days, or an average of $15.81 per day; the power cost at the steam-drilled well was about $100 per day, while the cost of installation of the equipment for the two wells was practically the same. The salvage value of the San Martinez electric power equipment is estimated at about 90 per cent. of its full value.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1923.

5,075. "Electric welding machines." A. E. White (Elyria Iron & Steel Co.). February 21st, 1923. (219,043.)

7,662. "Means for starting electric motors." R. Sucsek and J. Sousedik. March 17th, 1922. (195,086.)

7,752. "Generation of waves for wireless telegraphy and telephony by thermionic valves." C. Seymour, H. Merris-Airey, G. Shearing, and C. Matthews. March 17th, 1923. (219,053.)

10,112. "Loud speakers for use in wireless telephony." Johnson and Phillips, Ltd., and W. H. Johns. April 13th, 1923. (219,070.)

10,318. "Electrically-heated ovens." C. A. Baker. April 16th, 1923. (219,077.)

10,352. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. September 11th, 1922. (203,653.)

10,353. "Telephone systems with impulse senders for use in connection therewith." Automatic Telephone Manufacturing Co., Ltd., and F. Tench. April 16th, 1923. (Addition to 175,260.) (219,079.)

10,374. "Telephone, telegraph, and like receivers." J. Walton. April 17th, 1923. (219,081.)

10,456. "Phototelegraphs." Dr. A. Korn. April 17th, 1923. (219,083.)

10,479. "Terminals for electrical conductors." E. L. Wiegand. April 17th, 1923. (219,084.)

10,570. "Wireless receiving apparatus." A. H. S. MacCallum. April 18th, 1923. (219,088.)

10,676. "Resonance arrangements, particularly applicable to electric relays." C. Oliver. April 19th, 1923. (219,093.)

10,714. "Sound emitting or transmitting instruments." British Thomson-Houston Co., Ltd., and J. H. Butcher. April 19th, 1923. (219,095.)

11,292. "Detectors for wireless instruments and the like." Gramostyles, Ltd., and H. Jenkinson. April 26th, 1923. (219,113.)

11,897. "Insulation of electrical conductors." H. K. Whitehorn. May 2nd, 1923. (219,115.)

12,818. "Type of arc-welding holder." T. C. Winfield and J. C. Rea. May 14th, 1923. (219,121.)

12,834. "Electric devices for singeing hair and the like purposes." J. W. Barnard and T. C. Dawkins. May 14th, 1923. (219,122.)

13,232. "Means for protecting electric current networks." J. E. Pollak (Hengelosche Elektrische en Mechanische Apparaten Fabriek). May 17th, 1923. (219,125.)

14,678. "Electric condensers." A. H. Railing, A. E. Angold, and J. Stanley. June 5th, 1923. (219,135.)

16,475. "Amplification of electric currents." British Thomson-Houston Co., Ltd. June 26th, 1922. (199,741.)

19,505. "Electric fire." H. H. Berry and J. W. Reid. July 30th, 1923. (219,178.)

19,697. "Air-brake dynamometer engine power-testing mechanism." Armstrong Siddeley Motors, Ltd., F. R. Smith, and B. W. Shilson. August 1st, 1923. (219,179.)

20,000. "Wireless apparatus." C. H. Woodward. August 4th, 1923. (219,185.)

20,100. "Air-brake dynamometers." Armstrong Siddeley Motors, Ltd., F. R. Smith, and B. W. Shilson. August 7th, 1923. (219,187.)

23,168. "Brushes for rotary electric distributors or timers for the ignition systems of internal-combustion engines." E. W. Turner. September 15th, 1923. (219,207.)

25,460. "Mercury arc rectifiers." E. Marschner. October 12th, 1923. (219,215.)

25,742. "Ignition plugs." R. Bosch Akt. Ges. October 16th, 1922. (205,518.)

28,120. "Trolley heads for electric traction." Unity Engineering and Chemical Co., Ltd., and A. Muir. November 8th, 1923. (219,224.)

29,679. "Electric switches." Metropolitan-Vickers Electrical Co., Ltd. December 13th, 1922. (208,521.)

30,709. "Holder for valves of wireless sets." R. H. Winter. December 6th, 1923. (219,234.)

32,089. "Method and apparatus for forming filaments of electric incandescent lamps." H. E. Fenchelle and Lasarre (London), Ltd. December 21st, 1923. (219,239.)

1924.

6,515. "Cocks provided with electric liquid-heating means." A. F. E. Hanson. March 10th, 1923. (212,929.)

7,837. "Electric switches." Luma-Werke Akt Ges. March 28th, 1923. (213,595.)

An Electrically-propelled Passenger Ship.—Contracts for the construction of a large electrically-propelled sea-going passenger liner have recently been given the Cramp Shipbuilding Co. by the American-Hawaiian Steamship Co., Inc. The turbo-electric propulsion equipment will consist of two Curtis turbines with a total of 20,000 h.p. and water-tube boilers burning oil. The turbines will drive two alternating-current generators of 7,700 kW each, which in turn will drive two General Electric synchronous motors of 10,000 h.p. connected directly to the propeller shafts. The vessel will cost about $5,000,000, and will operate between San Francisco and Honolulu; accommodation will be provided for 600 first-class passengers and 250 members of the crew. Two years will be required to complete the vessel.

Aluminium Production in Germany.—It is stated that the three existing works which produce crude aluminium (Bitterfeld, Lautawerk, and Grevenbroich) turned out 9,900 tons of aluminium in 1923, whereas the consumption reached some 16,000 tons per annum. The difference had to be obtained from abroad, but as an import veto still exists, it was only possible to get deliveries from abroad under a system of licences. The latter can only be obtained if the managements of the three producing works express their unwillingness or inability to supply the tonnage for which export permits are required. It is stated that these works are now advocating the imposition of an import duty on aluminium so as to place them in a position of monopoly.